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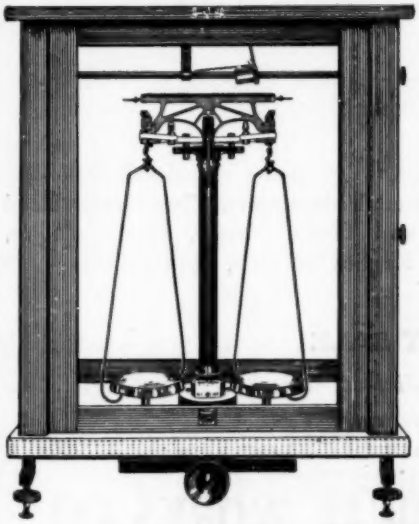

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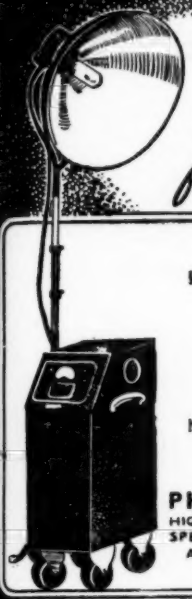

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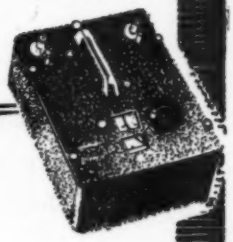

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INDUSTRIALISATION AND THE NATIONAL GOVERNMENT*

I often ask myself why a country like Canada, Australia or the United States of America is so prosperous and why India happens to be backward and poor. How are the citizens of the countries named able to live to twice the age that our people in India do, and how have they managed to raise their standards of living to their present high level and lead prosperous lives?

The reasons are plain. More than 85 per cent. of the Indian population is illiterate; the bulk of them have no idea of present-day world trends, of the changes that are going on in the conditions of existence and of the moral obligations and material precautions which could give them protection and safety. They do not know, for instance, that modern nations have acquired power and strength because they train themselves and give great attention to industries and earn larger incomes from industries than from agriculture. The Indian rural citizen who forms the great bulk of our population has a dislike to give up traditional habits, he has no idea what practices and behaviour really lead to profitable living, and he has no plan of life. When an Indian workman in the interior happens to have sufficient money in his possession to keep his elementary needs satisfied for a fortnight, he dislikes work and is inclined to take a holiday. His mind is not trained to take thought of the future and he has not got the capacity for group effort to promote beneficent practical ends on any appreciably large scale.

The main reason is illiteracy and ignorance, and the principal remedy to remove these defects is the long-range one of mass education.

One other special remedy for these weaknesses is for the Government to appoint boards or committees of leading men of

* Presidential Address by Sir M. Visvesvaraya, at the Second Quarterly Meeting of the Central Committee of the All-India Manufacturers' Organisation, July 11, 1948.

known probity and high character and charge them with the duty of preparing Rules of Conduct and Models of Behaviour, the practice of which is common among modern nations, and circulating the same by attractive propaganda. Good things will not come to our citizens without effort and preparations. We have to work for them; hence this suggestion that we should compare ourselves with nations who are leading orderly lives and are prosperous, and prepare slogans and leaflets based on such comparison to induce our large static population to lead more active and disciplined lives and thereby become more useful to themselves individually, and to the Indian nation collectively.

THE INDUSTRIALISTS' DIFFICULTIES

The country's weaknesses as stated before are due to the traditional habits and unplanned life of the people and particularly to neglect of industries. The previous Government was by its very nature opposed to rapid industrialisation. The present Government is national and the business public expected much from it. They had hoped that all the handicaps that existed formerly would be removed at one stroke and that the business public including the labour population would benefit greatly by the change. In the opinion of business men who are in close contact with manufacturing activities in foreign countries, there is disappointment that problems are not widely and openly discussed and correct policies are not frequently enunciated to give confidence and hope to the public.

I asked a few business friends of our Organization in Bombay to meet together and give me a brief list of the impediments to industrial progress at the present time. Their statement is comprised under six heads, which, summarised, reads as follows:

1. *Raw Materials.*—Imports and supplies of essential industrial raw materials are, it is stated, restricted and controlled. Consequently delays occur and industrial operations, etc., suffer. Examples of such materials are steel, pig iron, virgin metals, industrial processing materials, fine chemicals including most of the organic chemicals, industrial solvents, industrial fuels and machinery.

It is recognised that there is a world shortage of all these materials, but a more business-like handling of the representations and complaints of delay by Government staffs could, it is said, very greatly ease the situation.

2. *Transport.*—Much inconvenience is caused by difficulties of transport. Cement is being produced in sufficiently large quantities but the A.C.C. Ltd. have had to close down two of their factories. Corruption and inefficiency are also said to be rampant which create artificial shortages. If the transport situation does not improve many other industries may have to be closed down similarly.

Shortage of petrol and diesel oil have curtailed the more general use of road transport. Coastal shipping has not sufficiently recovered from war effects. No systematic attention is paid to the development of internal river transport.

3. Provincial Governments very often adopt new policies without giving previous notice to the public. Orders are often issued which interfere with the regular operations in industries or the sale of their products without giving sufficient previous intimation.

4. Provincial trade barriers are created by restrictions put on the movement of specific materials like oil seeds or milk products or timber or machinery. The resulting necessity of obtaining licenses and permits leads to inordinate delays, corruption and hardship to all concerned.

5. Ministers of Government sometimes express views which place impediments in the way of new industrial ventures and discourage investors. The opinion is widely held that the premature anxiety of the present Government for socialism and nationalisation is responsible for a feeling of nervousness about the country's economic future.

Individual members of Government may hold socialistic views but they should not give expression to them unless their colleagues in the Cabinet have also accepted them. Such expression leads to uncertainties and loss of confidence.

6. *Labour Difficulties.*—Industrial production has fallen and costs of products have risen by frequent strikes. Costs of production are rising and there is a falling off in the quantities of manufactured goods. The present situation is attributed to the desire of some of the Ministers to please the working classes in order to be able to obtain their political support at the first election that may take place when the new

Constitution is adopted. Labour, it is said, is made a pawn in the political game. Even socialists and communists are said to be fomenting labour troubles and holding out impossible promises with a view to catch the labour vote.

Since the organized industrial labour forms less than 2 per cent. of the total population, such attempts at bolstering up the economic condition of the workmen at the cost of the remaining 98 per cent. of the population cannot but lead to great hardships and loss to the entire country.

First Step should be to Strengthen Defence

Industries needed to strengthen the country's Defences should be given preference over every other case which is working for profit.

As regards technological knowledge the most urgent need is to train people in mechanical engineering, chemical technology and other special subjects for the maintenance of a strong defence force for the country. Government may be satisfied with the adequacy and efficacy of their military arrangements; but in a democracy the public who give thought to these subjects will want sufficient information to be assured of the safety and security of their country against possible foreign aggression.

In America and Canada the national leaders are acquainted with defence arrangements and can get full information regarding the fighting strength of their people and also of their comparative international strength if they wish to have the information.

In India hitherto persons interested in such topics were not allowed even to look over the fence. Military secrets need not be revealed but it is hoped an early change will come over the attitude of Government and a good number of leaders in all parts of the country will be able to keep watch over the growth of the country's military strength.

The British Cabinet issues a White Paper periodically to give assurance to its public in this respect. The latest paper issued bears the title "Statement relating to Defence in 1948". The British public often enquire whether a sufficient number of leading men are retained in the Army and whether conditions in service establishments are sufficiently attractive to draw a fresh supply of talented younger men.

There is great need that similar statements to assure the public that the country's security is closely watched, should be issued in India.

No Statistics Available of Existing Industries

This is an elementary duty of any Government interested in the business life entrusted to its care. The British Government were not in favour of any statistical measurement of the results of their Administration.

In Canada and Australia, progress in industries in such matters as:

Number of establishments,
Capital invested,
Number of employees,
Salaries and wages paid,
Cost of materials,
Quantity and gross value of products produced, and
Per capita value of output,

are published once a quarter.

I have been appealing to Government in this country to remedy this defect ever since I took an interest in economic matters, both in public addresses and by publications. An Indian Economic Enquiry Committee appointed by the Government of India in 1925 of which I happened to be the Chairman made specific recommendations for collection of statistics. But no serious attempt was made by any responsible head of the administration at that time or subsequently to remedy this grave defect or even to discuss the proposals in public.

The capital invested in and the *per capita* income derived from industries, if correct statistics be available, will give an idea of the progress of the country in industrial activities and towards industrial prosperity.

A legislative enactment has been passed to collect statistics but the Government have not enforced it everywhere. It is understood statistics have been collected for about 40 per cent. of the industrial establishments. These by themselves will be of little value to assess the progress made unless all the establishments are brought into the picture.

The present Government has been in office for less than a year and they cannot be held responsible but they must give the

public an idea of what they are doing and how soon this age-long defect will be remedied.

Three Institutes of Technology

It is learnt that the Government of India have decided to establish two Institutes of Technology, both of them on the M.I.T. model, one in or near Calcutta and the other in or near Bombay.

It is also gratifying to learn that certain prominent leaders in South India have decided to start an Institute of Technology in Madras City. Although the resources so far offered are slender, the initiative taken in this case is most praiseworthy.

Great care is necessary to see that it does not take much time to equip these three institutions with buildings, machinery, staff and essential apparatus and furniture. Here is an opportunity for Government to lay aside routine methods and resort to some kind of serviceable rush tactics. Otherwise it might take decades before satisfactory institutions in these three cases come into view. Since the private endowment for the Madras Institute is small, it is the duty of the Government of the Province to go to its rescue and make liberal grants.

One way of getting this done is by appointing a Sub-Committee of three leaders (or one capable reliable man if one such both reliable and capable could be found) to help to construct buildings for, and *equip these three institutions* speedily on a contract basis. Respectable firms should be invited to consider the proposal. It must be recognised that Government establishments will not be adequate to cope with the demands in this respect within a reasonable time.

The times are abnormal, the need for developments is urgent and the procedure to be resorted to to gain the objective, even if unusual, should not be rejected.

Respectable business firms may come forward and undertake to do their best if the transaction is entrusted to their care as in the case of contracts in war time. In such cases the risk must be taken ; a good offer should be accepted. In the present circumstances it would not be inappropriate for a Minister or the Cabinet to invite offers, formally or otherwise, and accept any reasonable proposals finally with the approval of the majority of members of the Cabinet.

Past Attempts to Establish Technological Institutes

There is a sorry tale to tell of past attempts at establishing such institutions in Bombay and Calcutta.

It is probably not remembered that the establishment of an Institute of Technology on the model of M.I.T. was recommended by a Bombay Government Committee in 1921-22. The Indian members of the Committee unanimously supported the proposal while the European members opposed it and the Bombay Government of those days shelved the whole report.

The University of Bombay being dissatisfied with the Government attitude to a problem of this importance appointed a committee of its own to arrange for instruction in Chemical Technology. That Committee recommended the establishment of a University Department for the purpose. The Department has been since established and is now working satisfactorily in the quarter of Bombay known as Matunga.

The Institute now proposed to be established in or near Bombay will, it is hoped, be mainly to promote knowledge and skill in higher technology in engineering and research in industries, in the first instance, and to enlarge the same gradually by adding new departments as funds and experience become available.

They have a National College of Engineering and Technology at Jadhavpur in Calcutta which is entirely independent of Government help or control but owing to its slender resources, the scope of instruction attempted is limited. I understand no Government grant was asked for nor given. I have not yet heard whether the new Government of West Bengal has begun to give substantial help to this very deserving institution.

Present Three Urgent Wants of Industries

Some of the more urgent wants of industrialists and business men at the present time are capital, machinery and experts.

No country can be said to be militarily or economically self-contained and strong if the people are not trained to manufacture heavy and delicate machinery and tools. India cannot be regarded as an Industrialised Modern State if its skilled public is not equipped with such capacity.

I have dealt with the question of the need of capital in the previous discussions. Heavy industries cannot be developed without large investments in the shape of capital. Canada has invested about Rs. 2,500 crores of capital and the benefit to that country is that the gross value of products manufactured annually is more than Rs. 2,500 crores. Similar results or even comparatively better results may be expected in the early days of this new development in this country.

It is feared that this aspect is not given the importance due to it by the authorities in power either in New Delhi or in some of the Provinces.

Nationalisation would be quite good as a policy for the manufacture of defence machinery. Some few small Government plants exist on the Bengal side which were started in the days of British rule. Nationalisation of selected key industries which do not pay business men to take up may not be objectionable. Government management will not be economical in the present circumstances. This frequent reference to nationalisation by Government authorities has unnerved industrialists and business men and confidence is shaken throughout India. I do not know what steps Government of India are going to take to bring back confidence to investors and make the wheels of industry go round smoothly in future.

Prospects of Obtaining Help from Big Industrial and Financial Corporations of U.S.A.

America has been willing to supply these wants namely, machinery, experts and even capital.

It is true on account of the last war the manufacturing countries in the West have had to replace the worn-out plant of their own industries and it is difficult for them to supply what this country wants in proper time. But there are various ways of getting over the difficulty.

I can speak from personal knowledge that large financial firms in America like the financial firm of Rockefeller of New York are willing to help this country in this emergency if only there is a satisfactory understanding between the two countries at the Government level to remove impediments and allow facilities to flow freely into India from that quarter.

It is not meant that Government should take any financial responsibility. The financial firms in America should be placed in contact with the business firms in India who undertake to organise large-size industries. It will be a transaction between the business Boards or managing agencies in India in charge of large industries and financial and other firms in America who are accustomed to export machinery and supply of experts for setting up industries of large size in foreign countries.

The financial houses have access to trusted groups of manufacturers, technologists, machinery manufacturers and others in their country and they are willing to supply to any important undertaking in India all that the latter may want. They feel a sense of responsibility for all work undertaken through their agencies.

When blue prints are ready, orders may be placed with the industrial groups under the influence of the parent financial firm. The latter will take the responsibility for fair dealing to a certain extent.

The supply of machinery can be quickened. The financial firm will organise and place valuable facilities at the disposal of promoters of any industry in this country provided the promoters make it worth its while.

Business men in India know how the late Mr. C. P. Perin of New York helped to build the first steel industries in India. Men of Mr. Perin's calibre and probity can be had even now if a close search is made for them. But they must be paid high fees and remunerated liberally. Mr. Perin was paid a fee of Rs. 25,000 to Rs. 30,000 per month for the time he spent in India. I can say from personal knowledge of the services he rendered that he was not overpaid at these rates.

Next to the understanding between the Governments, money can buy anything that is wanted if not from U.S.A., at least from one or more smaller countries of Europe. The supply of machinery can be also quickened if in special circumstances sufficiently high prices are paid to make it worth the while of manufacturers to supply them.

As stated above next to the understanding between two Governments money can buy anything which our industries require if not from U.S.A., or U.K., at least from the smaller countries of Europe

like Sweden, Switzerland, Hungary and Czechoslovakia, among others.

Some Few Developments Considered Very Necessary

Some few important developments are considered necessary in the present industrial organization of the country. These are :—

(1) *Appointment of a Deputy Minister.*—The industrial needs of more than 300 million population are entrusted along with the question of supply to one Minister. In spite of very able men being in the Ministry, in spite of their exceptional very hard work, big questions necessarily take a long time to get settled and delays in current matters create untold hardships to the industrialist public. The appointment of a Deputy Minister seems necessary who should be made responsible for the routine business of the Department leaving the Chief Minister time to get into closer contact with leading manufacturing firms and industrialists.

The addition to the staff of a responsible Deputy Minister ought to help greatly to increase production and minimise malpractices. The present hardships of a vast population will be substantially eased.

(2) *An Economic Council.*—An Economic Council, that is, a representative body to give continuous attention to the economic interests of the country is also a necessary measure to bring Government authorities, officers, industrialists and business leaders into closer contact. This will lead to more rapid promotion of business because the official mind will be better known to the public and the needs of the public better understood by officers and authorities.

(3) *A Liaison Agency.*—It is suggested that two or three members of the Economic Council may be specially selected for employment to be used as a liaison agency both by the Gavernment and the Council. The picked men who would be serving on this Agency may be made to work up schemes in co-operation with promoters of such schemes by collecting all necessary details for them from any part of the country or of the world, by air travel. In this way when pressed for time any large industry can be organised and started in about three months time.

(4) *A Special Bureau or Board.*—A special Bureau or Board should be brought into existence for maintaining a continuous study of the latest developments in industries in Western countries. Much of such information can be gathered also through technical journals and publications. The country should be kept up-to-date by such means in the sphere of industries.

(5) *Decisions and Action.*—The democratic ideal is that decisions should be made by a Committee or other democratic body but that the responsibility for action should be entrusted to one, or a few men, of capacity and character. There is wisdom in a multitude of Councillors but for implementing a scheme or a project, one person of capacity and probity, or a group of three persons of character and capacity, should be selected and given full responsibility for execution. Time, funds to be spent, and the specific form of results expected may be prescribed. In other respects this small executive agency should be given full freedom and discretion. One or two cases in every ten may go wrong but that may be counted as part of the price paid by the country for rapid or efficient execution.

(6) *Machinery Manufacture.*—An effort should be made on an extensive scale to spread the knowledge of mechanical engineering and machinery manfacture in the country. Factories and workshops with this definite objective should be established to make up for past omissions. The people should be given opportunity and freedom to manufacture machinery and machine tools. Rewards should be given for skill in this respect. One Japanese way of development was to take a foreign machine to pieces and distribute the pieces among skilled workmen or students with instructions to each person to prepare an exact counterpart. When all the parts were ready a new machine similar to the original one was produced. This may be taken as one of the many practices which enthusiastic instructors usually adopt to teach the younger generation the ability to manufacture machinery. Due to lack of opportunities for practice, there is an appalling dearth of original thinking and enterprise in this respect in our midst.

(7) *Selection of Experts.*—In order to get satisfactory men from abroad the Government or the business firm concerned

may have to pay two or three times the fee or salary that experts get in their own country. The price paid for securing efficient experts is often a flea-bite compared to the value or the results obtained by securing good men and by making good use of them when secured.

In deciding all these matters the broad facts should not be ignored that we are dealing with the country's industrial production which the modern world considers to be of the greatest value for any country's protection from foreign aggression and protection from want, and we are dealing also with a national emergency brought about by the systematic retardation of industries for over a hundred years.

Concluding Observations

I have said before that large sums of money have to be invested if there is to be any real progress in manufacture or production under the head industries in this country. I have elsewhere suggested that not less than Rs. 400 crores per annum should be invested as capital in industries for the next five years of which Rs. 100 crores may be investment direct by Government. We may have to spend from current revenues on staff, equipment, subsidies, etc., at least Rs. 10 crores more every year for encouraging the birth of new industries. The experience in this field is: "You must spend well in order to earn well."

Business leaders Mr. G. D. Birla and Mr. A. D. Shroff have been suggesting the same thing namely the need of large investments if the country is to make a mark in industries. Even if Rs. 400 crores per annum are spent during the next five years, the total capital expenditure at the end of the fifth year will be not more than what Canada with a population of only 12 million has already invested in industries. Money has to be borrowed as soon as necessity is felt and America would be quite willing to supply it if satisfactory business relations are established between the two countries at the Government level. The contracting parties to the loans will be not the Governmet of either country but financial or other large firms in America which lend the money on one side and private business firms in India which use it on remunerative industries on the other.

The arrangements here indicated are similar to what America herself followed in building up her industries by borrowing money from England towards the end of the last and the commencement of the present century. Before the first World War, America in her relations with Great Britain was a debtor country. She built up her industries and ten years later became a creditor to Great Britain herself. Investment of capital will lead to increase of gross products and income. Extreme caution in borrowing and investment will leave the country weak and poor. Courage is needed. Conditions in India have been extraordinary. Having been subjected to suppression and retardation in the past, industries are no more than a wreck at the present time and they therefor e are in need of strong Government sympathy and support.

With an uneducated population and its abnormally low earning power, new methods similar to those suggested by the practices of the West, are necessary for industrial rehabilitation and such necessity should be recognised by the Governments both at the Centre as well as in the Provinces. There should be no objection to borrow money, if, as is believed, it can be done in this case without political risks, and use it as capital to promote industries because the money so used is not actually spent on current needs but will be invested in industries and become real interest-yielding assets. The present emergency demands that Government should follow courageous policies and take all reasonable measures necessary to raise the working power of the people and through the working power the prosperity of the country.

SCIENTIFIC INFORMATION SERVICES

SPEAKING at the Opening Session of the Royal Society Scientific Information Conference, called to examine the possibility of improvement in existing methods of collection, indexing and distribution of scientific literature, Sir Edward Appleton. G.B.E., K.C.B., F.R.S., Secretary of the Department of Scientific and Industrial Research said :—

"We would all agree that no scientist gives of his best in isolation. But in spite of everything we manage to do to foster the movement of scientists, and to effect personal contacts between them, we have to admit that they live chiefly on the printed word. After all, it is often by the medium of publication that a scientific worker may be helped—and indeed often inspired—by a fellow worker whom he may never have seen and who lives thousands of miles away.

Science has been well served in the past by the publications of its Learned Societies and Academies and by the scientific journals. But the spate of scientific publications is now such that it is becoming extremely difficult to keep abreast with events on even the most limited sector of the scientific frontier.

This spate of scientific publications may, I think, be illustrated in the following way. If anyone set himself the task of merely reading —let alone trying to understand—all the scientific journals published and worked solidly at his task every day for a year he would discover that at the end of the year he was already more than 10 years behind. If the same constant reader had included the technical literature as well he would find himself about 100 years behind in his work after 12 months effort.

Obviously something must be done to relieve the situation and it is the object of this Conference to find out what that something should be. The really important objectives to be achieved are three-fold. First, to ensure that the scientist gets all he needs ; secondly, that he gets it quickly ; and thirdly, that he gets it in the right form and shape. Any solution you recommend must, however, be practicable. It must be reasonable in cost and it must take into ccount the acute shortage of scientific manpower which is hampering the development of almost every scientific organisation in the world—and certainly every organisation in the British Commonwealth.

It seems to me that you will reach satisfactory solutions of the problems which are before you only if you keep constantly in mind the needs of the scientific user. And you have got to protect him from indigestion as well as to give him the sustenance he needs. You are concerned with this question of the spate of scientific literature. My library contains many a lengthening file of unread journals. The great majority of those journals will *never* be read—and still less understood—by me. Personally what I require, as a working scientist, are reprints or separates of the papers that matter to me. And I want them quickly and in a form easily storable. In choosing the reprints of the papers I require I want the guidance of brief abstracts to inform me of the existence and contents of those papers. These should be short, conveniently classified for the user, and should be available soon after the papers are printed. Scientists working in other fields may well have different needs and it may be necessary for you to engage in some form of operational research to enable you to formulate user needs more precisely. Indeed I gather that something on these lines has already been started.

Then there is the question of translations. Here is certainly a field where co-operation will lead to economy of effort. I well remember that, during the early part of the War, I discovered that a certain German paper, which had an important bearing on radar, had been independently translated by three Government Departments. It was, of course, easy to prevent that kind of thing happening again within the limited field of Government science but we want to see economy of this kind extended to all scientific information services."

THE HON'BLE PRIME MINISTER, ORISSA, ASKS :— "CAN NOT THE SCIENTISTS RESCUE THE POOR VILLAGERS FROM THE WRATH OF FIRE?"

INDIA consists of 75,00,000 villages where people, due to poverty, live in huts. Almost all the houses in the rural and a large number even in the urban areas are thatched with straw. In the Province of Orissa except a very few all houses both in urban and rural areas are straw thatched. This year's experience shows that a very large number of houses have been burnt down in the country side of Orissa during the severe summer and in many places the fire could not be brought under control by the villagers. Loss on this account is enormous both to the people who have been deprived of their lives' savings and to the Government who have rushed relief to the stricken.

It is now high time for our Scientists to solve a problem of national importance by evolving a method for making straw fire-proof.

AIR MASSES IN TROPICAL CYCLONIC STORMS FROM RADIO-SONDE DATA

S. L. MALURKAR AND P. R. PISHAROTY
Poona 5

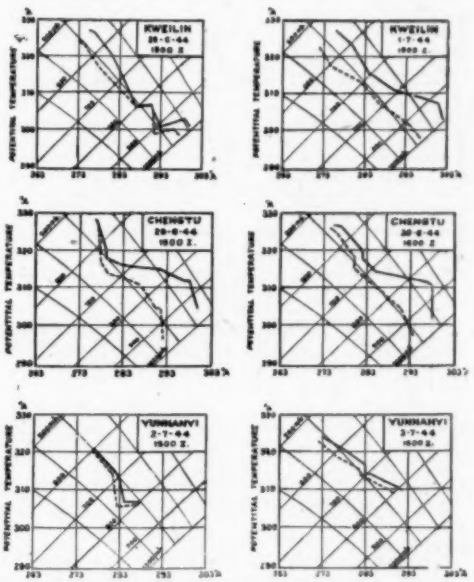
IN an attempt to study the air masses[1] in the Indian area associated with monsoon depressions or with the pre- and post-monsoon months, it was found that one has essentially to deal with three distinct air masses with separate regions of travel. The air masses entering into the structure, of all tropical cyclonic storms or depressions, could be considered as nearly the same. In the absence of one of these air masses, usually, no westward moving tropical depressions formed and only a low pressure wave resulted.

The air-masses are: (1) air from the S. hemisphere whose incursions across the equator occur at discrete intervals. The character of this air after crossing the equator remains sensibly the same (Fm); (2) air from the Far East ultimately the N. Pacific high which forms part of the 'N. E. Trades', its character is essentially stable but the temperature and humidity depend on the season and region of travel, and (3) dry continental air, with its large diurnal variation of temperature, from regions to the west of the depression. The properties of the air masses are described elsewhere.[2]

The tracing of the far eastern air as a distinct one was not easy. The observations, from regions east of India, were not available. Even in pre-war days, the area from S. China to Upper Burma was not meteorologically well represented. In the Pacific Ocean, the data were still less. Only, Deppermann[3] had tackled the question of air masses near the Philippines. The isobaric configuration in N. E. India, the weather sequence before the onset of a monsoon depression and the nature of precipitation showed that an air mass distinct from that of fresh monsoon air and also from dry continental air was involved. During the year 1944, radio-sonde ascents were made at a number of stations in India and the neighbouring countries like S. China.

With the close of the war, the radio-sonde stations, which were mostly maintained by the army air force of the U. S. A. in places bordering to the east of India were closed down. The detection of the far eastern air, with only data from inside India, would again present difficulties, if the experience gathered during the war period was not utilised and recorded.

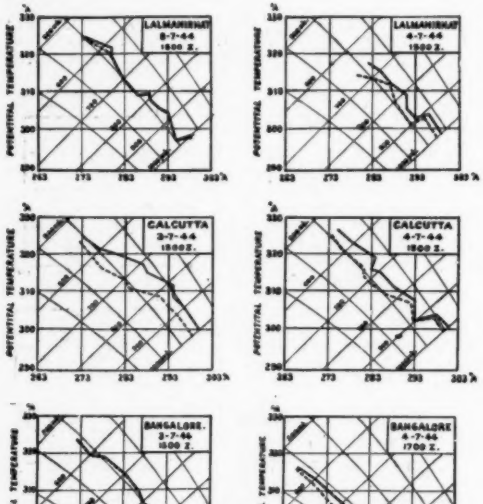
Technique.—The radio-sonde data are recent in and near India.[4] In the temperate latitudes where the temperature and humidity change considerably with different air masses, the small instrumental defects can be ignored. But in the tropics, the temperature changes associated with different air masses near a depression are small. One is apt to ignore altogether the significance of small changes as being below the limit of instrumental errors. If one depended solely on the upper air temperature and humidity data, it may be the correct attitude. When the data are used along with synoptic charts, their utility cannot be challenged. The incursion of fresh air masses can be checked up alternately from surface and upper air data. When all the T - Ø grams are studied, the shape of the curves indicates the incursion of fresh air masses. The fall or rise in temperature at higher levels, if shown in a sequence at a number of stations far away from one another or if shown simultaneously at nearby stations can be relied upon and should not be ignored.



The deductions in this paper were confirmed in every instance when there was a tropical depression and upper air temperatures available. Only one typical example of a monsoon depression and one typical tropical cyclonic storm are cited here. The examples have already been looked into from the surface indications to minimise space. Only the very essential diagrams are given. The diagrams for days immediately preceding and succeeding days are only described. For the same reason, the question of tracing of the continental air, which can be done even on surface charts has not been stressed.

Observations : Based on the westward passage of a shallow low pressure area south of the equator and the rise of pressure at Mauritius in the preceding 24 hrs., a forecast for a week-ahead was issued on July 3rd, 1944, that the monsoon may strengthen in the Indian area during the latter half of the week. It was expected that a 'pulse' of fresh monsoon air was about to cross the equator and form a depression at the head of the Bay of Bengal

after three or four days. The Bay depression formed on 7th July 1944. Pisharoty[5] has cited the T - Ø grams of Bangalore for 4th and 5th July and shown that an 'unstable' or more accurately a less stable than usual air passed over the place; and that similar less stable air masses passed over Bangalore before the formation of other monsoon depressions, at the head of the Bay of Bengal. In the following θ_w is used as wet bulb potential temperature in the absolute scale of degrees, and only the numerals are put in.



Main features of the diagrams are only given.

Bangalore

3rd July 1944. Between 900 and 840 mbs. θ_w was greater than 296, while it was just 296 between 840 and 800 mbs. It was again greater than 296 between 800 and 630 mbs., and it was 295·5 between 600 and 525 mbs. The curve was almost dry adiabatic between 630 and 600 mbs.

4th July. The curve was super-adiabatic between 900 and 780 mbs. θ_w falling from nearly 298 at the surface to 290 at the higher level. θ_w was between 291·5 and 290 from 780 to 525 mbs.

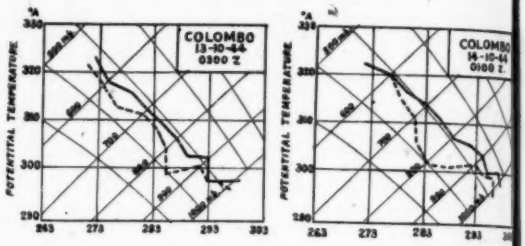
5th July. From 900 to 650 mbs., the curve is almost a straight line, θ_w being 297 and 291·5 at the extreme levels. At heights above 650 mbs. θ_w was greater than 291·5

6th July. No ascent.

7th July. θ_w was everywhere greater than 295 and often greater than 296.

The drop in the wet bulb potential temperature showed that there was an incursion of fresh air over Bangalore on 4th July 1944 (*cf.* Pisharoty, *loc. cit.*). The air was not quite stable. It could easily give rise to or maintain thunderstorms. The only source of colder air at the top could be from the southern hemisphere where it was winter.

The data for the Far Eastern Transitional or Mixed air (Tr) are derived from Kweilin (110° 10′ E, 25° 15′ N.), Chengtu (104° 02′ E, 30° 15′ N.), Yunannyi (100° 44′ E, 25° 25′ N), Lalmanirhat (Assam) and Calcutta.



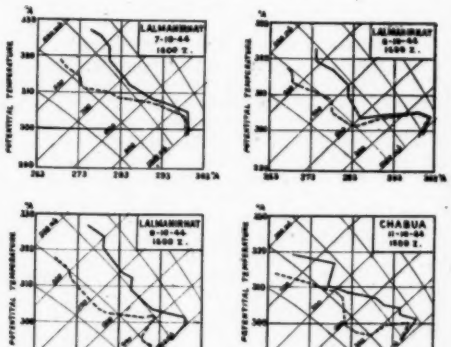
Kweilin :

28th June 1944. The curve is slightly superadiabatic from 950 to 920 mbs. and almost dry adiabatic from 840 to 800 mbs. θ_w was less than 298 at all heights above 930 mbs.

29th and 30th June. No ascents.

1st July. θ_w was above 298 upto about 780 mbs.

2nd July. Nothing special to report.



Chengtu .

29th June 1944. Dry adiabatic between 850 and 650 mbs. showing a fresh incursion of air over the place.

30th June. The fresh incursion of air persisted.

Yunannyi

1st July 1944. "Normal curve." θ_w almost 297·5.

2nd July. Short flight; between 800 and 750 mbs.—dry adiabatic and higher up the temperatures had fallen since previous day and θ_w was there 296.

3rd July. Temperatures had increased upto 700 mbs. Lapse-rates were between dry and wet adiabatic values.

4th July. "Normal curve"—all temperatures had increased.

Lalmanirhat

3rd July 1944. Almost super-adiabatic lapse-rate from ground to 970 mbs. Nothing else of importance.

4th July. Temperatures had fallen from the previous day from 920 to 820 mbs. θ_w was 298 upto 910 mbs. and below 298 at heights above that level.

5th and 6th July. No ascents.

7th July. θ_w touched 302 at the height corresponding to 960 mbs. and was above 298 at all heights upto 580 mbs.

Calcutta

3rd July 1944. The curve nearly saturated upto 780 mbs. θ_w was 300.

4th July. From 940 to 840 mbs., a wedge of cold air had come in and above 840 mbs., θ_w did not exceed 298·5.

5th July. No ascent.

6th July. "Normal curve."

There is an unmistakable incursion of a fresh air mass from Kweilin on 28th June 1944 to Chengtu on the 29th, to Yunannyi on 2nd July and to Assam and Bengal on the 4th July. At Lalmanirhat and Calcutta, the thickness of the layer is almost the same and occurs at the same height intervals. *The air is not dry nor unstable.* By the time the air reaches Bengal, it is more moist and hotter than Em, as shown by a comparison of θ_w over Calcutta and Bangalore, being 300 and 290 respectively.

The surface charts, earlier than 7th July, show distinctly the incursion of fresh dry continental air into the Bay.

The Far Eastern air, that came over Calcutta and Lalmanirhat on the *same day* as Em over Bangalore, shows a definitely higher temperature and has to be treated as a distinct mass from the east and not as part of an 'old monsoon' stream. The Far Eastern Transitional air (Tr) passes over the neighbourhood of the thermal equator and over regions which are fully saturated due to swamps and forests in the track from Indo-China to Burma. The air is hotter and very much more oppressive than Em. Deppermann also noticed the hot air to the northeast of the Philippine typhoons, but did not follow it very much.

During the middle of October 1944, a tropical cyclonic storm formed in the Bay of Bengal. Between the 12th and 13th October 44 a 'pulse' of fresh monsoon air crossed to the north of the equator.[6] From the radio-sonde ascents, it is seen below that a fresh air mass passed over Colombo on the 13th.

Colombo

12th Oct. 1944. θ_w was more than 296 upto 640 mbs. The curve was dry adiabatic from 850 to 760 mbs.

13th Oct. From ground to 940 mbs.; the lapse-rate was dry adiabatic and also again from 900 to 850 mbs. Above 850 mbs. θ_w was 295.

14th Oct. Temperature curve almost normal. θ_w was greater than 296 upto 670 mbs.

The radio-sonde ascent of 6th Oct. shows a distinct colder wedge of air between 700 and 550 mbs. In the next available ascent on 10th, there is no such wedge.

Lalmanirhat

7th Oct. 1944. Curve normal.

8th Oct. From 940 to 800 mbs.—slight superadiabatic lapserate. All temperatures less than on the previous day.

9th Oct. Colder wedge from 900 to 600 mbs. can still be seen; though the shape of temperature curve has recovered.

10th and 11th Oct. Fresh incursions of air. After that date for a few days, the curves were normal.

Calcutta

12th Oct. 1944. A remarkable wedge of cold air between 800 and 600 mbs. The air is not moist though not very dry.

13th Oct. The temperature curve had recovered.

The fresh air mass that was over Chengtu about the 6th of Oct. 1944 passed over Calcutta on the 12th to feed the Bay depression; while the fresh 'pulse' passed over Colombo on the 13th. The fresh air mass from the east is not very moist in this season. Data from an earlier epoch than the depression have to be examined as Tr may have to travel longer in case of tropical cyclonic storms.

The data of Chittagong and Chabua (Assam) generally support the incursion of fresh air mass for the above cyclonic storm. Chabua shows layers of subsidence from 675 to 640 mbs. and again from 550 to 515 mbs. on the 11th. This disappeared on the next day.

The dry continental air gave a sharp wedge on 5th Oct. 44 extending from Russian Turkestan to Mekran and brought in unusually low temperatures over N. W. India. The low temperatures gradually extended throughout N. India during the course of the succeeding week and descended down the latitudes to feed the depression in the Bay of Bengal.[7]

It follows that the upper air temperatures confirm the conclusion that three distinct air masses are involved in the tropical cyclonic storms and in the monsoon depressions. Elsewhere,[8] it has been pointed out that the easterly upper wind stream should not be looked for just north of the place where ultimately a depression forms but should be noticed very much further north, just as in the case of the extra-tropical cyclones.

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1. Malurkar, "Forecasting Weather in and near India," 1945 (limited ed.), p. 42, and p. 87. 2. Malurkar, *Curr. Sci.*, 1948, **17**, 112. 3. Deppermann, 'Outlines of Philippine Frontology.' 'Are there Warm Sectors in Philippine Typhoons,' 1937. Weather Bureau, Manila. 4. Data printed in Indian Daily Weather Reports. 5. Pisharoty, "Combined Role of Fresh Monsoon 'pulses' and Easterly Waves in the Formation of Monsoon Storms", *Symp. Nat. Inst. Sci. (India)*, Aug. Sept., 1946. 6. Malurkar, "Forecasting Weather, etc.," *loc. cit.* 7. *Ibid.*, 8. Malurkar, 'Role of three air masses in Tropical Cyclonic Storms' at present MSS.

Note.—The cost of printing this article has been met from a generous grant from the National Institute of Sciences, India.

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ON THE FLAME SPECTRUM OF CuCl

The purpose of this note is to report the observation of some new bands of CuCl which have been found while studying the flame spectrum of this salt with quite a different objective.

The spectrum of CuCl is rather easily excited in the flame and has been studied by a number of workers. The more recent work is due to Ritschl[1] who has measured a large number of bands between λ 5506 and λ 3997 A. These bands have been arranged into 5 different systems, usually denoted as systems A, B, C, D and E with their 0,0 bands at λ 5262, λ 4882, λ 4847, λ 4354 and λ 4333 A, respectively.

In course of the present investigation of the flame spectrum of CuCl, bands have been observed to as low wavelengths as λ 3500 A. The CuCl flame was obtained by burning asbestos thread, wound over an iron ring and soaked into the solution of the salt in water, over a Bunsen burner. A specially built large aperture quartz spectrograph, with dispersion nearly the same as that of the small quartz spectrograph supplied by Adam and Hilger, was used to photograph the bands. Besides the CuCl bands in the regions noted by other workers, some more bands were observed at lower wavelengths. Their measurements are given in the table below, and since the dispersion employed was very low, they will be correct only upto ± 3 A. The reason why they were not previously observed is probably that the spectrographs used were not fast enough to record these faint bands.

Table I

Some additional CuCl bands in flame

λ_{air} (A.)	$\nu_{vac.}$ (cm.$^{-1}$)	v', v''	$\nu_{vac.}$ (calc.)	λ_{air} (A)[2]
4005	24960	8, 3	24963	4010
3950	25310	9, 3	25325	3945
3890	25700	10, 3	25694	3885
3835	26070	11, 3	26061	3835
3785	26415	12, 3	26420	3785
3735	26770	13, 3	26780	
3685	27130	14, 3	26136	
3570	28005			
3490	28645			

It is difficult to say whether the new bands belong to one of the old systems or they form a new system by themselves. They are, however, found to fit in quite well with system E of Ritschl, and a tentative assignment of their vibrational quantum number is also given in the table. They seem to represent the heads of the sequences $\Delta v = 5$ to 11. Other members of the sequences could not probably be resolved at this low dispersion. Column 4 of the table gives $\nu_{vac.}$ for the calculated positions of these bands

and in view of the low dispersion employed, the agreement does not seem unsatisfactory. Lord Rayleigh and Fowler[2] who studied the spectrum of this salt excited by active nitrogen, also observed a few bands in this region; their measurements are given in the last column of the table.

Science College, Patna, S. P. SINHA.
May 29, 1948.

1. Ritschl, R., *Z. Phys.*, 1927, **42**, 172. 2. Lord Rayleigh and Fowler, A., *Proc. Roy. Soc.*, **A**, 1911, **86**, 105.

SQUARES OF NUMBERS

IN the June 1947 issue of the *Current Science* (Vol. **16**, No. 6, pp. 178–79) Azizuddin Ahmad Siddiqi addressed a letter to the Editor explaining "A New Method of Obtaining Squares of Numbers". Though there is nothing very much new in the method, it simply seems to have been an attempt at popularising its use as "*a simple and ready method*" It may, however, interest your readers to know that the method sponsored is only a special case of the gereral rule for the multiplication of any two numbers, and that even the general rule itself can be presented in a much simpler manner. This is best illustrated by an actual numerical example below: Suppose two numbers 2,734,681 and 64,537 are to be multiplied. There are 7 digits in one and 5 in the other. In order that they may have equal digits add two zeros to the left of 6 in the second number and write them down one below the other as under:

X= 2734681
Y= 0064537

7.....first row
59
71
90
101
150
102
77
56
50
12

Z= 176488107697

The process begins with the multiplication of the two units place digits in the two numbers X and Y. Put this result down below in the first row. Cross-multiply the units and tenths place digits in X and Y and put down their sum one place to the left in the second row. Next cross-multiply the units, tenths, and hundredths place digits in X and Y and similarly put down the sum of the three sub-products two places to the left in the third row, and so on. The continued process of further cross-multiplication and summation is self-explanatory. In all, there will be $p+q-1$ rows obtained from the original number of p digits in X and q digits in Y. When this process is complete, add up the digits in the units places in the several rows to obtain the units places digit in the final product number Z, and so on for all the other place digits with the system of carry-over being observed. The result Z will be the final product required.

It is easy to explain the method described above in the language of algebra as below. Remembering that any positive integral number having $k+1$ digits can always be expressed in a series form as

$$a_0+10a_1+10^2a_2+10^3a_3+\ldots\ldots+10^ka_k$$

the product of two such series

$$a_0+10a_1+10^2a_2+10^3a_3+\ldots\ldots+10^ka_k$$
$$x_0+10x_1+10^2x_2+10^3x_3+\ldots\ldots+10^mx_m,$$

where $m \leqslant k$ has been obtained in all standard text-books on algebra as

$$a_0x_0+10\,(a_0x_1+a_1x_0)+$$
$$10^2(a_0x_2+a_1x_1+a_2x_0)+\ldots\ldots$$
$$+10^m\,(a_0x_m+a_1x_{m-1}+\ldots\ldots+a_mx_0)+\ldots\ldots$$
$$+10^{m+r}\,(a_rx_m+a_{r+1}\,x_{m-1}+\ldots\ldots+a_kx_{m+r-k})$$
$$+\ldots\ldots+10^{m+k}a_kx_m$$

where r assumes all positive integral values up to $r=k$. The reason for placing the various sums in the different rows in the illustrative example above in the manner explained is at once obvious from the last algebraic expression obtained for the product of two numbers.

Statistics Branch, C.W.I.N.C., New Delhi, G. M. PANCHANG. R. V. VISWANATHAN.
April 23, 1948.

MANGANESE CHLORIDE EMISSION BANDS

EXCITING the vapour of manganese chloride in a heavy current discharge from a 2,000 volt D. C. Generator through a continuously evacuated quartz tube with hollow cylindrical electrodes, a characteristic band system attributed to the diatomic molecule MnCl is obtained between λ3900-λ3500 consisting of seven well-separated marked close sequences of violet degraded bands. The bands have, in part, a line-like appearance and have subsidiary components, besides the chlorine isotopic heads. Pearse and Gaydon[1] have made a brief mention of bands ascribed to this molecule by Mesnage from a study of High Frequency discharge through MnCl. Only the first members of three sequences are reported. A much more extensive system has been obtained by the author and the vibrational analysis has led to the following constants, $\omega_e' = 412{\cdot}0$ and $\omega_e'' = 384{\cdot}1$, the anharmonic constants being very small. The chlorine isotopic shifts completely support the analysis. Details will be published elsewhere.

Andhra University, Waltair, P. TIRUVENGANNA RAO.
June 25, 1948.

1. Pearse and Gaydon, "Identification of Molecular Spectra," 1941, 136.

MESON TRACKS ON PLATES EXPOSED ON THE NILGIRIS

THIS note gives the results of measurements on cosmic ray tracks obtained on photographic plates, which were exposed in the open on the Niligiris in South India during Nov.–Dec. 1947. A set of Ilford nuclear research, type B 1,100 μ thickness emulsion plates, contained in a paraffin-covered cardboard box was exposed for six weeks at Ootacamund (altitude 7,300 feet) and a similar set contained in a thin wall aluminium case was exposed, during the same period, at Aruvankadu (altitude 6,700 feet). A Zeiss microscope fitted with a 44 X objective and a 10 X micrometer scale eyepiece, was used for the measurements of the tracks on the plates. The average number of meson tracks as identified by their characteristic low grain density, large angle of scattering and thick grain dens.ty towards end of range, are found to be 0·52 and 0.47 per sq. cm., on the plates exposed at Ootacamund and Aruvankadu, respectively. The track lengths are found to vary from 100 to 800μ, with the majority of them around 150μ. The lower limit for the number of mesons that arrive per day per c.c., therefore, at the altitnde 7000 feet and geomagnetic latitude 2·8° will be 0.7. Of the 32 tracks examined, only two, whose lengths are 570μ and 590μ, seem to correspond to the μ-decay meson observed in the photographs of Lattes and co-workers.[1]

We thank Messrs. S. Ramachandra Rao of Ootacamund and K.Doraiswami of Aruvankadu for assistance in exposing the plates on the Niligiris.

Central College, Bangalore, *July* 8, 1948.

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1. C. M. G. Lattes, *et al.*, *Nature*, 1947, **160**, 485.

ROLE OF THREE AIR MASSES IN TROPICAL CYCLONIC STORMS

A CYCLONIC storm is strictly "tropical" when three air masses Em, Tr and Tc or Tcm enter into its formative structure and when it has a westward tendency of motion.[1] The properties of air masses have been described elsewhere.[2] There is considerable divergence regarding the need and the role of the air masses: whether the release of latent heat of moisture or whether the waves set up at the interface of two necessary air streams as in the extratropical latitudes give rise to a tropical cyclonic storm. In the lower latitudes, the component of earth's angular velocity is small. An approach to the problem should tackle both the production or release of energy and the cyclonic vorticity. I have pointed out earlier that Em, the equatorial maritime air, acts as the thermodynamic 'source', that Tc or Tcm, the tropical continental air or the tropical continental maritime air, acts as a 'sink' and that Tr, the far eastern transitional or mixed air, is required to delay the cycle of operations till sufficient cyclonic vorticity is developed.[3] In the tropics, cyclonic vorticity and release of energy are two distinct entities and may not necessarily co-exist.[4] A closed low pressure area is characterised by a vertical structure with an almost dry adiabatic lapse-rate over several kilometres and over a short height with even super-adiabatic lapse-rate. The situation is such that it is favourable for maintenance of convection.

It has been known for a long time, though it has had to be re-stressed at intervals, that the southerly air, which has its origin in the 'S. E. Trades' in the southern hemisphere, was a necessary concomitant of the weather over a large part of the Indian area during and near about the northern summer. As the theory of cyclonic storms is to be the same everywhere in the tropics, it is sufficient to deal with conditions in the north Indian Ocean. For the release of energy of monsoon depressions and tropical cyclonic storms, Em is needed. An examination of the vertical structure of temperature and humidity of Em shows that it can easily release energy. Em has to be the 'source' for the release of energy.

For the major period that tropical cyclonic storms or monsoon depressions form in the Indian area Tr is hotter and in the lower layers mostly more moist than Em. Both the dry and wet bulb potential temperatures of Tr are greater than that for Em. This warm or hot easterly air has not been found to behave analogous to the air of the 'warm sector' of an extra-tropical depression by Deppermann[5] and others. The precipitation occurs from lower heights than 12,000 ft. There is also a marked temperature inversion in the 'Trades' between 1·5 and 2·0 km. Hence Tr cannot be considered as a 'source' and certainly not as a 'sink' of a tropical cyclonic storm.

The continental air is dry, often very dry. For depressions that form in the Bay of Bengal, the movement of Tc can easily be followed by the temperature waves from beyond the N. W. frontier of India (geographical).[6] Here the potential wet bulb temperature of the air is considerably below that of either Tr or Em. This air has some sea travel, for depressions that form in the east Bay of Bengal or east Arabian Sea. But this sea travel of Tc is much smaller than that for Tr. Hence Tc or Tcm can play the role of 'sink'.

In the temperate latitudes, the westerly winds are to the equatorial side of the easterlies. This juxtaposition gives rise to a 'natural' cyclonic vorticity. In the tropics, in the non-monsoon months, and during breaks of the monsoon, the strength of the westerlies generally decreases on approaching the equator. In the monsoon months, Tc has a westerly component and Em has a westerly and occasionally an easterly component. In the absence of an easterly Tr north of Em; the natural vorticity, in the tropics, that one can expect is anticyclonic. To overcome the latter and induce a cyclonic vorticity, one or both of the following should happen: the westerly component of Em should be increased and the westerly strength of Tc should be decreased, so that the westerly component of the wind may decrease with increase of latitude. With the passage of a monsoon 'pulse' or Em across the equator from the southern hemisphere to

the Bay of Bengal; the winds at Mannar, Trincomalee, Trichinopoly and often at Colombo reach gale force below 2 km. The corresponding wind force before the passage of Em would be light to moderate. The second condition is satisfied if an easterly stream due to Tr is superposed on the field of Tc. If there be a sufficient supply of Tr, the juxtaposition would show a cyclonic vorticity in the neld. If at the interface of Em and Tr, unstable perturbations are set up, the conditions would lead to the formation of a tropical cyclonic storm. The fact that there is considerable difference in the properties of Em and Tr need not complicate the issue except to demarcate the streams. The release of energy must be due to Em and Tc or Tcm. It is difficult to assess which two streams of the three must first come into play. In the description of tropical cyclonic storms[7] all the instances that occurred over two years have been taken into account, and an examination was made of cyclonic storms for a period of nearly ten years. The facts were consistent with the assumption of the air masses above.

It has been argued as a serious objection to the above picture that, in the formative stage, there was no easterly component of wind to the north or northeast of the centre of the tropical cyclonic storm. Dr. Sverre Petterssen showed, in his talk on Feb. 11th, 1948, at the Poona Meteorological Office, that if a cyclonic vorticity is induced due to the shear at the partition of Em and Tr in the north tropics, the resulting depression would form to the southeast of the area enclosed earlier by the two streams. It appears necessary to look for the easterlies in the formative stage of a tropical cyclonic storm much further north than the subsequent centre of the storm. In other words, a tropical cyclonic storm forms to the southeast of the triangular area formed by the three streams Em, Tr and Tc or Tcm and not inside it. This clears up a number of small but essential difficulties.

It is often noticed that a small low pressure area travels westwards across Assam and north Bengal showing the passage of a residual of a China Sea typhoon. But the resulting monsoon depression forms often in the north angle of the Bay of Bengal and gives an apparent southward travel to the residual of the typhoon. The incursion of Tr is shown by the westward passage of shallow low pressure areas.[4] The low pressure area over Assam and north Bengal may not necessarily be due to the actual westward passage of the China Sea typhoon but may just indicate the incursion of Tr. The formation of the monsoon depression much further south of Tr becomes understandable from last para.

The passage of Em across the equator is discontinuous and occurs only at intervals. As Em moves north to form a tropical cyclonic storm, it does not form a continuation of the S.E. Trades on the other side of the equator. Between Em and the equator the mixed air Tr and Tc can and does flow. This allows the passage of northern Tr to the south to form the Em of the southern tropical cyclonic storm that often forms in a more easterly longitude. The invasion of Tr, south of the tropical cyclonic storm and the equator, also allows the infeed of Tr to a secondary tropical cyclonic storm in the same hemisphere forming in a more westerly longitude. The secondary tropical cyclonic storm must form to the south of Tr. The secondary tropical cyclonic storm in the same hemisphere and in a more westerly longitude, would be therefore much further south than what one would have expected from only elementary considerations. This fact is amply borne out by the tropical cyclonic storms that form in the Bay of Bengal which can be considered as secondaries of China Sea typhoons. Due to paucity of observations, it may happen that the primary and secondary tropical cyclonic storms get mixed up and the tropical cyclonic storm is given a large southerly direction and movement.

Poona 5, S. L. MALURKAR.
February 12, 1948.

1. Malurkar, *Curr. Sci.*, 1947, **16**, 277. 2. *Ibid.*, 1947, 174 and "Recent Advances in Tropical Meteorology", *Ind. Sci. Congress Symposium*, Jan. 1948. 3. Malurkar., *Curr. Sci.*, 1947, **16**, 14. 4. Malurkar, *Proc. Ind. Acad. Sci.* (Bangalore), 1947, **25**, 297. 5. Depperman. "Are there warm sectors in Philippine Typhoon" Weather Bureau, Manila, 1936. 6. Malurkar, *Forecasting Weather In or Near India*, 1945, **43**, 90. 7. *Ibid.*, 63.

A NOTE ON THE PETROLOGY OF THE CORUNDUM AND CHROMITE-BEARING ROCKS OF THE SITHAMPUNDI-RAMADEVAM AREA, NAMAKKAL TALUK, SALEM DISTRICT, MADRAS

DURING the re-examination of the Sithampundi corundum belt, a hitherto unrecorded occurrence of chromite ore was located. The results of a preliminary examination of the rocks of this area are outlined below :—

Anorthite-hornblende gneisses form an arc shaped belt, with a southerly convexity, and run for a length of nearly fifteen miles, from Pattalur in the west to Kottakkalpalaiyam in the east. The general trend of these gneisses is W.N.W. in the west gradually veering to E.N.E. towards the eastern end and maintaining an uniform southerly dip. The chromite-bearing amphibolites and the associated pyroxenites and pyroxene-garnet rocks occur interbanded along the foliation planes of the anorthite-hornblende gneiss. Several bands of chromite-bearing amphibolites of varying thickness traverse practically the whole of the anorthite gneiss belt.

The anorthite-hornblende gneiss is an even grained pale coloured rock, essentially made up of basic feldspars and greenish black amphiboles, the latter arranged with their longer axis parallel to the general direction of foliation. Textural, as well as mineralogical variants of the main type are met with, some varieties being salic, wherein the development of minerals like chondrodite, zoisite, scapolite and garnet is marked. The corundum for which these rocks are quarried occurs sparsely distri-

buted in the rock and is generally surrounded by a shell of calcite, and is of a pale green colour. But a pink variety of the mineral occurs along the intrusive contacts of the anorthite gneiss and chromite-amphibolite. It is probable that the two varieties of the mineral are of diverse origin.

In thin section the rock is equi-granular and made up of a groundmass of broken up basic feldspars. These have been described as 'Indianite' (anorthite) by Count de Bournon. Determinations of the An content of a few pieces of the mineral on the Fedorov universal stage however, show them to range in composition from An = 55% to 100%. The pieces examined displayed twinning of the ALA, MANEBACH, and MANEBACH-ALA types. Variation in the An content of adjacent lamellæ to the order of 18% is a feature recorded in some of the pieces examined. The amphibole noticed in these rocks is of a pale green variety with the following optical characters :—

X = yellow green, Y = pale green, Z = grass green, $2V = -80° \pm 4$, $C \wedge Z = 13° \pm 2$, conforming to those of Actinolite. Other minerals noticed in micro-sections of these rocks are, chondrodite, garnet, apatite, corundum, scapolite and clinozoisite (Fouqueite) with $2V = \pm 88°$.

The chromite bearing amphibolite is a beautiful green rock made up of acicular needles of green hornblende, and grains and stringers of chromite, while grains of pink corundum are noticed in the rocks along the contact zone. Experiments on the electromagnetic concentration of this rock show the maximum chromite content to be about 55 per cent.

In thin sections the rock is made up of an aggregate of green pleochroic amphibole with the following optical characters :—

X = green, Y = yellowish green, Z = bluish green, $2V = \pm 78° \pm 4$, $C \wedge Z = 23° \pm 3$ (or even 30°). It is probably a variety of pargasite. In some of the microsections a non-pleochroic bladed amphibole displaying straight extinction was noticed. The optic axial angle was found to be $2V = -84°$, indicating it to be the rhombic amphibole gedrite. The fine play of colours exhibited by the mineral in hand specimens may be attributed to the presence of microscopic inclusions. Other minerals observed are zoisite, corundum, picotite, secondary chlorite and talc.

The garnetiferous pyroxenite is made up of a groundmass of diopsidic pyroxene ($2V = +56°$) in which are embedded crystals of pale yellow garnet which show alteration to kelyphite and chlorite. The rock is devoid of feldspars. The pyroxenite is an aggregate of clino and ortho-pyroxenes, the former has the following optical constants, ($2V = +48°$; $C \wedge Z = 40°$), while the latter is pleochroic hypersthene.

Origin of Corundum.—As already referred to, the pale green corundum in these rocks is generally covered by a shell of calcite. This is suggestive of the splitting of anorthite by the action of CO_2, produced during the intrusive period, and the consequent formation of Al_2O_3 and calcium carbonate ($CaO\ Al_2O_3\ 2SiO_2 + CO_2 = CaCO_3 + Al_2O_3 + 2SiO_2$). The possibility of such action is supported by the presence of veins of calcite and quartzin the area.

The corundum in the amphibole rock may be due merely to an excess of alumina in the original basic intrusive, probably a pyroxenite. Its abundance in the zone of contact with the anorthite-corundum gneiss may be attributed to concentration during intrusion possibly aided by chemical changes resulting in the production of free alumina.

Our grateful thanks are due to Dr. M. S. Krishnan for his valuable suggestions in the preparation of this note.

Madras, N. K. N. AIYENGAR.
May 24, 1948. A. P. SUBRAMANIAM.

VERMICULITE IN MYSORE

WHILE engaged in the mineral survey of the Pavagada taluk, Tumkur District, a yellowish-brown micaceous mineral with a bronzy lustre was noticed lying scattered in the neighbourhood of pits from which corundum had been taken out. The mineral swelled enormously when heated, more than ten times its original volume and turned fluffy and silvery grey in the process. This property of expansion by exfoliation with a worm-like movement is characteristic of vermiculite and it was therefore considered that the brittle mica was no other than vermiculite possessing its characteristic property. Subsequently, similar brittle mica, but of different shades of colour, was met with in some of the altered ultrabasic rocks near Koratagere and Nidavanda in the Tumkur District. These also possessed the property of expansion by exfoliation. Whether at any of these places vermiculite is found in abundance and in quantities capable of being commercially exploited remains yet to be investigated.

Vermiculite is one of the few minerals which till recently had remained obscure and known only as an alteration product chiefly of the micas. It is only recently that it has come to be of importance as the mineral which has revolutionized building construction. Vermiculite which when expanded weighs only 6 to 8 lbs. per cu. ft. as compared to sand which weighs 100 lbs. is used as a substitute for sand or gravel in plaster and concrete to save weight. Vermiculite plaster is said to be fire proof and sound proof, and on account of that is extensively used in the construction of radio studios, theatres, libraries, etc. It is used in making panels for prefabricated houses. Many new uses of vermiculite are being found and the demand for vermiculite is daily increasing. The important deposits of vermiculite are in Montana and North Carolina, U.S.A., and new mines are being developed in the Transval, South Africa.

The object of the present note is merely to draw the attention of investigators in the field to the possibilities of finding commercially important deposits of vermiculite in our country especially in areas which show lenses of basic and ultrabasic rocks in the Gneisses. The extent of the now known occurrences of vermiculite in the Tumkur District is being investigated and the results of the investigations will be published elsewhere.

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June 16, 1948.

WATER-MELON (*CITRULLUS VULGARIS* SCHRAD.) AND FOOD-POISONING

UNLIKE in the other countries, notably U.S.A and U. K., the problem of food-poisoning in India has received little attention so much so a large number of instances occur even without our ever recognizing them. That the food-poisoning may occur in the least suspected source as fresh grapes has been pointed out earlier [2] On May 6, 1948.[3] "*The Times of India*". reported that eight persons who ate a water-melon were removed to the hospital for treatment of food-poisoning, and added that one of them succumbed to the infection. It was of interest to examine if water-melon could serve as a suitable medium for the growth and distribution of at least the common organisms responsible for food-poisoning.

Bharucha and Bharucha[1] have already studied water-melon in connection with *V. cholerœ*. We have now tested the suitability of water-melon juice as a medium for the growth of typhoid and paratyphoid group of bacteria. Water-melon juice was obtained by cutting open triangular pieces from the scrupulously cleansed. and sterilized (alcohol) surface portions of the fruits specially selected for the purpose. It was possible to collect sterile juice (as tested by inoculation on MacConkey's agar only) necessary for the experiment by this procedure. The juice collected from each fruit was distributed in 10 *ml* quantities in sterile tubes and inoculated with 0·1 *ml* of thin culture-suspensions (made in sailne and matching approximately to Opacity Tube No. 1) of surface-grown agar cultures (24-hrs. old) of *E. typhosa* (Watson V. strain N.C.T.C. 5761), *S. paratyphi* (N.C.T.C. 5702), *S. schottmuelleri* (N.C.T.C. 5705), *S. enteritidis* (N.C.T.C. 5765), and *E. coli communis* (N.C.T.C. 415). The tubes were then incubated at the room temperature (30-31° C.) after 0·01 *ml* portions from each tube were removed for the quantitative estimations of the bacteria seeded in them. Further 0·01 *ml* aliquots removed from each tube at the end of 3-hrs., 6-hrs., and 24-hrs. were also, after suitable dilutions, employed for the enumeration of the bacteria. In all the cases plates of MacConkey's agar were utilized and the colonies developing on them were counted after incubation for 24-hrs. at 37° C. In every experiment the pH of the juice was also determined. The following table gives the results obtained from a few typical experiments.

The results show that all the tested bacteria grow well in the juice upto the period to which the test lasted. The growths of the *Salmonella* species representing the food-poisoning group (Para B and the enteritis strains) were particularly heavy. The juice samples inoculated with these two bacteria began to give rise to small but visible bubbles of gas within even 2-4 hours after incubation, and the turbidity produced by them in the juice after 24-hrs. growth was of the magnitude of Opacity Tube No. 3 or even No. 4. Moreover these two bacteria indicated some conspicuous cultural changes not exhibited by the other test bacteria. These changes, however, remain to be studied in detail. Another important feature in these findings is the influence of the initial pH of the juice on the multiplication of the bacteria and which is evident from the figures above. In conclusion, it may be said that water-melon, if and when contaminated, affords an excellent substratum for the growth of the intestinal bacteria, specially the organisms of the food-poisoning group; it is not therefore surprising that this fruit is known to be associated with outbreaks of food-poisoning.

Expt.	pH	Species	Colony counts per *ml* of the juice			
			Initial	3 hrs.	6 hrs.	24 hrs.
			×10⁵	×10³	×10⁴	×10⁵
1	5·6	T	95	112	25·7	26
		A	108	156	31·1	11·2
		B	168	401	605	181
		E	144	199	294	117
		C	94	175	105	360
2	5·8	T	90	110	115	159
		A	35	255	263	202
		B	290	785	943	651
		E	545	935	2790	1943
		C	10	60	300	540
3	5·9	T	190	205	290	201
		A	230	600	805	203·5
		B	14	880	1100	331
		E	95	155	460	299
		C	140	160	580	257·5
4	6·4	T	150	180	90	985
		A	160	525	470·5	657
		B	95	380	342	960
		E	60	730	1388	1888
		C	10	145	116	380
5	6·6	T	940	1060	6570	960
		A	290	550	4920	660
		B	610	1285	8080	1160
		E	305	695	1180	1260
		C	755	915	4780	689

Legend: T = *E. typhosa*; A = Para A; B = Para B; E = *enteritis*; C = *E. coli*.

Further work on viability and the cultural, antigenic and other characteristics of these bacteria in the juice is in progress.

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June 6, 1948.

1. Bharucha, F. R., and Bharucha, K. H., *Jour. Univ. Bomb.*, 1938, **6**, 5, 35-40. 2. Bhat, J. V., Reporter, R. N., and Fernandes, F., *Curr. Sci.*, 1945, **14**, 324-25. 3. "*Times of India*," 1948, **110**, 107, 5.

THE REFRACTIVE CONSTANT OF WHOLE AND SKIM MILK

THE measurement of refraction in milk as a means of detecting adulteration has already been reported.[1] The studies on adulteration with skim milk[1-2] showed that while the refractive index remains unaltered,[3-4] the rising density of the product steadily decreases

TABLE I

Limits of Refractive Constant of Whole and Skimmed Cow and Buffalo Milk

	Density (20° C.)		R. I. (40° C.)	Refractive Constant	
	Whole	Skim		Whole	Skim
Cow	1·0274–1·0314	1·0342–1·0376	1·3458–1·3471	0·2065–0·2075	0·2059–0·2065
Buffalo	1·0258–1·0330	1·0324–1·0410	1·3471–1·3492	0·2076–0·2088	0·2058–0·2065

the value of the refractive constant. It was felt that elimination of fat, the most variable constituent of milk, might further narrow down the limits of the refractive constant. From the resulting data it would be possible to assess the advantage or otherwise of this value as compared with the refractive constant of whole milk.

45 samples of cow and buffalo milk of various grades of refractive index and density were used for this experiment. After taking the density (lactometer reading) of whole milk, the latter was separated in a hand-worked cream separator up to an upper li r it of 0·2 per cent. fat in the skim milk. The density and refractive index (Abbe' refractometer) of the skim milk was then tested. The determinations on both skim and whole milk are given in Table I.

The data show that the limits of the refractive constant of average samples of milk are appreciably lowered and narrowed down by skimming. While for samples of whole cow milk the limits ordinarily lie bet veen 0·2065 to 0·2075,[3] for defatted milk they lie between 0·2059 to 0·2065. For buffalo whole milk the constant lies between 0·2076 to 0·2088,[3] for defatted milk it is narrowed to 0·2060 to 0·2065 for average samples.

Now, it will be observed that the range of variation of the co stant of skim milk of both cow and buffalo are almost identical. This is, of course, to be expected, as the solids-not-fat of the two milks do not differ to the same degree as do their fat contents. But this overlapping in the range of the constant of skim milk robs the advantage of distinguishing the two types of milk, possessed by the non-overlapping refractive constant of whole milk.[3] Further, the determination of the constant for skim milk denies the chance of detecting even gross adulteration with skim milk or of defatting.[2]

I am thankful to Prof. V. Subrahmanyan and Mr. B. N. Banerjee for their kind interest.

Department of Biochemistry, Indian Institute of Science, Bangalore, *January* 14, 1947.

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1. Rangappa, K. S., *Curr. Sci.*, 1946, **15**, 230. 2. —, (in Press). 3. —, *Proc. Indian Acad. Sci.*, B, 1947, **25**, 86. 4. —, *Nature*, **160**, 719.

VISCOSITY OF LIQUIDS AND TEMPERATURE

A SIMPLE exponential relationship between viscosity and temperature has been proposed by different authors[1] in various forms, *viz.*,

$$\eta = A.\ e^{B/T}$$

where η = Viscosity
A and B are constants characteristic of each liquid.
T = absolute temperature.

Recently, certain limitations of this equation have been pointed out by Leontieva.[2]

In the present note, an empirical relationship between viscosity and temperature has been proposed. When viscosity is plotted against temperature, a curve is obtained. The curvature is substantially diminished on plotting logarithm of viscosity against temperature. On plotting logarithm of logarithm of viscosity against temperature, straight lines were obtained for many liquids. An equation of the following type is, therefore, proposed:

$$\log (\log \eta) = A - BT$$

where η = Viscosity in millipoises,
A and B are constants for each liquid
T = absolute temperature.

In the following table some typical examples are taken and the maximum differences between observed[3] and calculated values recorded:

TABLE I

Compound	Temperature range in °C.	A	$B \times 10^3$	Maximum Percentage +	Difference −
Octane	0–100	0·8036	3·20	1·4	0·7
Nonane	0–100	0·8568	3·16	0·2	1·0
Benzene	0–70	0·9353	3·50	0·3	0·5
Chloroform	0–60	0·6283	2·57	0·5	0
Acetone	0–50	0·7963	3·71	1·4	0·3
Ethyl Iodide	0–70	0·6018	2·45	0	0·2
Ethyl Formate	0–53	0·7864	3·43	1·0	0·1
Butyl acetate	0–100	0·8628	3·16	0	1·0
Acetic acid	25–95	0·8085	2·63	0·8	0·3
Methyl alcohol	0–60	0·9710	3·70	1·8	0·7
Trimethyl carbinol	32–77	1·9385	5·80	1·1	0·5
Ethyl propyl-ether	0–60	0·9470	4·26	2·3	1·0

The case of water deserves special attention. Andrade[4] found that equation (1) expresses

the viscosity of water within 0.5 per cent. from 100° C. to 60° C. Equation (2) gives the viscosity of water fairly correctly between 100° and 20° C. as may be seen from the table below. Lewis and Macdonald[5] have measured the viscosity of heavy water between 5° and 35° C. which also agree very closely with the calculated values:

TABLE II

Water : $A = 1{\cdot}23$; $B = 4{\cdot}3 \times 10^{-3}$

Temp. in °C.	Observed viscosity in millipoises	Calculated viscosity	% diff.
0	17·93	16·56	−7·6
10	13·09	12·71	−3·0
20	10·06	10·00	−0·6
30	8·00	8·048	+0·6
40	6·57	6·613	+0·7
50	5·50	5·534	+0·6
60	4·71	4·71	0
70	4·07	4·069	0
80	3·57	3·566	−0·1
90	3·16	3·162	+0·1
100	2·84	2·837	−0·1

TABLE III

Heavy Water : $A = 1{\cdot}431$; $B = 4{\cdot}74 \times 10^{-3}$

Temp. in °C.	Observed viscosity in millipoises	Calculated viscosity	% diff.
5	19·88	19·95	+0·4
10	16·85	16·87	+0·1
15	14·51	14·49	−0·1
20	12·60	12·65	+0·4
25	11·03	11·02	−0·1
30	9·72	9·74	+0·2
35	8·64	8·62	−0·3

The applic tion of this relationship at high temperatures will be discussed in a later communication.

My grateful thanks are due to Dr. M. R. A. Rao for kind advice.

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1. Raman, *Nature*, 1923, **111**, 532; Dunn, *Trans. Farad. Soc.*, 1926, **22**, 401; Andrade, *Nature*, 1930, **125**, 309; Sheppard, *Ibid.*, 1930, **125**, 309. 2. Leontieva. *Acta physicochimica U. R. S. S.*, 1947, **22**, 279. 3. "International Critical Tables and Landolt Bornstein Tabellen," 4. Andrade, *Nature*, 1930, **125**, 581. 5. Lewis and Macdonald, *J. A. C. S.*, 1931, **53**, 4730.

HEAT CONDUCTIVITY AND MOLECULAR COMPLEXITY OF WATER-PART II

THE author has shown previously[1] that the heat conductivity K of water decreases sensibly linearly with its degree of association *n*. That the data can be represented by the equation $K = 0{\cdot}002282 - 0{\cdot}0002389\ n$ is evident from the following table:

t (° C.)	n	$K_{obs.}$	$K_{calc.}$
10	3·86	0·00136	0·00136
20	3·60	141	1422
30	3·40	1455	147
40	3·24	1493	1508
50	3·12	1527	1536
60	3·01	1563	1563
70	2·90	1589	1589

The variation with t of K for water[2] follows the equation $K = 0{\cdot}001325\ (1 + 0{\cdot}002984\ t)$.

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June 8, 1948.

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DARLUCA FILUM (BIV.) CAST., A HYPERPARASITE OF *PUCCINIA GRAMINIS* AND *PUCCINIA TRITICINA* IN THE GREENHOUSE

IN INDIA, Butler and Bisby[1] recorded the occurrence of *Darluca filum* on uredinia of *Puccinia polygoni-amphibii*, Ramakrishnan and Narasimhalu[2] on *Puccinia purpurea*, *P. penniseti* and *Uromyces setariæ-italicæ*, Padmanabhan and Rafay[3] on *P. kuehnii* and Padwick[4] on *P. chrysopogi*, *Uromyces inayati* and *U. andropogonis-annulati*. During the course of the study of wheat rusts at Simla, the writer observed the pycnidia of *Darluca filum* on the uredinia of *Puccinia graminis* and *P. triticina* every year in the greenhouse in July, August and September when humidities are high (80-100%). It was found to be fairly troublesome in maintaining rust cultures since, in some cases, the pustules were almost destroyed. The pycnidia which are small, black, spherical and shiny, are found scattered amongst the uredospores. When put in a drop of water on the slide, long tendrils of colourless spores are seen to ooze out through circular openings of the pycnidia. These spores are either aseptate or uniseptate, oblong and straight, with or without small cilia at the ends and measure 3-5 × 9-25 μ.

Inoculations made in the greenhouse during July-September on wheat seedlings with infected material of *Puccinia graminis* and *P. triticina* resulted in the appearance of the rust pustules on which the pycnidia of *Darluca filum* were formed within 4-5 days in every case. Finally the infected pustule fell off from the leaf leaving a shot-hole. When these plants were removed from the greenhouse to a dry place soon after the formation of shot-holes, the rust continued to develop round the shot-holes and *Darluca filum* disappeared. If the plants were removed to a dry place before the formation of shot-holes, the uredinia were

formed in the normal way and after some time, no trace of *Darluca* was left.

Simultaneous inoculations made with infected rust spores on the plants maintained at a lower humidity resulted only in the formation of uredinia without its parasitizing fungus. Among the greenhouse cultures too *Darluca filum* disappeared after the rainy season.

These experiments, when considered with the observations made in the greenhouse for several years, show that *Darluca filum* can develop on these rusts only in very humid conditions as are prevalent in the hills during the rainy season.

Padwick[4] collected *Darluca filum* on *Puccinia chrysopogi* Barclay and *Uromyces inayati* Syd. in the last week of September at Simla. So far as the measurement of spores is concerned there seems to be little doubt that his collections and the fungus described here belong to the same species of *Darluca*. According to Keener,[5] Trayler[6] and Hardison[7] successful infection of several grain and grass rusts has been obtained by means of cross-inoculations with *Darluca filum* and it is quite likely that the greenhouse infections described here may be wind-borne from some grass rust infested with this parasite. Keener's[5] experiments, moreover, indicate that there are physiologic races in *Darluca filum* since any two collections may not behave alike in their rust host range.

Concerning the usefulness of *Darluca filum* in the control of cereal rusts in nature, it is apparent from what has been described here, that the growth of this fungus is largely governed by atmospheric humidities. It develops best where there is high humidity approaching 80-100%. In nature, such a state of affairs rarely, if ever, continues for long periods, specially during the wheat growing season. It is, therefore, useless to attempt to control wheat rusts in the field by *Darluca filum*.

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March 6, 1948.

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POTATO NECROSIS

Introductory.—Some of the potato plants of variety *Darjeeling Red Round* raised in the insect-proof house from virus-free seed tubers, stock of which had been built up during the last few years suddenly developed necrosis of the growing point which spread downwards and gave the plants wilted appearance. The leaves became pale and flascid and most of the plants were killed in due course. This was a very serious matter as part of the nucleus disease-free seed of this variety produced after considerable labour and expense was about to be lost. The problem needed immediate attention and investigation into the cause of the disease was taken up. The young leaflets near the growing point of the infected plants show outward, or inward curling of margins and some smalling and narrowing of young leaves may also be observed in certain cases. After about a week light diffused brown areas develop in the top leaves which after a few days turn completely brown and dry up. Later on the outward curling of margins progresses to all the leaves of the plant and the tips of leaves point downwards. Ultimately the necrosis first observed at the growing tip progresses down and the plant is usually killed. Fig. 1 shows a plant of potato variety *Darjeeling Red Round* affected by the disease. In addition, virus-free potato plants of varieties *President* and *Craig's defiance* which were being grown as differentials for analytical work on potato viruses were also found affected by a disease characterised by smalling and curling of margins of younger leaves. The leaves also exhibited diffused light brown areas resulting in drying up of the top leaves. The plants were, however, not killed as a result of the disease.

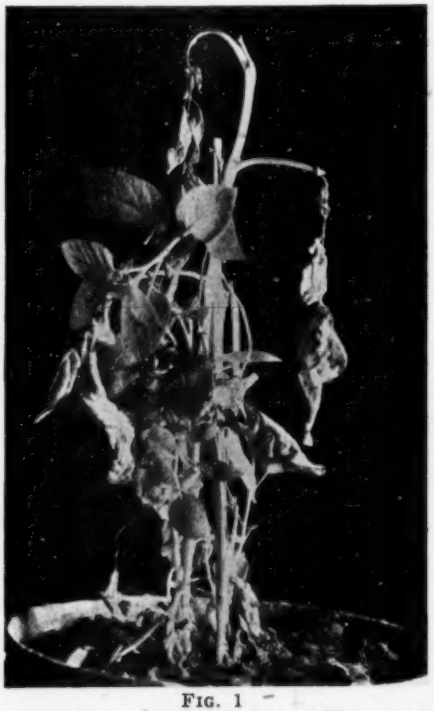

FIG. 1

Transmission of the disease.—The experimental work was carried out in an insect-proof glasshouse and always young vigorously grow-

ing healthy plants were used for transmission tests. All attempts to transmit the disease to potato plants by inoculation in the presence of carborundum powder as abrasive were unsuccessful. Also the disease could not be transmitted by mechanical means to a number of solanaceous hosts. *e.g.*, *Nicotiana tabacum* L., varieties White Burley and Harrison's Special, *Nicotiana glutinosa* L., *Datura stramonium* L., *Nicotiana sylvestris* Spegaz and Comes, *Solanum nigrum* L., *Capsicum annuum* L., *Petunia hybrida* Vilm. and *Lycopersicum esculentum* Mill. variety Sutton's Early Market. The disease was, however, successfully transmitted by grafting the diseased scions to healthy stocks of potato and certain other plants. Grafting was done both by wedge method as well as inarching and reactions on differential hosts were studied. As the disease was found to be transmissible only by grafting, it was necessary to investigate the cause of infection in the hitherto disease-free potato plants. It was observed that incidence of white-fly, *Bemisia gossypiperda* M. and L. was high in the fields during the period under report. Experiments were, therefore, conducted to investigate if white fly was responsible for transmission of the disease. Insects were fed on diseased plants in micro-cages and then transferred to healthy plants of *Nicotiana tabacum*, variety Harrison's Special and *Lycopersicum esculentum*. The insects were allowed to feed for 24 hours on diseased as well as on healthy plants. In the case of tomato after 11 days yellowish diffused mottle appeared on the leaves and all the newly formed young leaves showed slight twisting; with age the mottle became more pronounced. The young newly formed leaves of tobacco exhibited faint mottle and the leaves became harrow. Also tips of the leaves showed slight curling. The insect transmission tests were not conducted on potato due to non-availability of sufficient number of virus-free potato plants at that time.

Reactions on Differential Hosts, Lycopersicum esculentum, variety Sutton's Early Market.—In tomato two weeks after grafting with diseased potato plants of *Darjeeling Red Round* variety distinct mosaic mottle appeared on all the newly formed leaves which was followed by reduction in the size of leaves. The young leaflets were elongated and narrow with curled margins. Some of the leaves were wrinkled and twisted so much so that they exhibited cork-screw distortion. The older leaves showed leafcurl with tips of leaves forming a characteristic hook-like structure. With age the mottling became faint but smalling of leaves in the shoots and the hook-like structure persisted.

Nicotiana tabacum.—In variety Harrison's Special two types of symptoms were observed. All the plants invariably produced transient mottle in 13-20 days on all the new leaves. This was followed by a pronounced stunting of the plant and shortening of internodes. The mottling disappeared after a few days and the plant carried the disease without obvious symptoms. When scions from such tobacco plants were grafted to tomato typical symptoms of the disease appeared. In other cases the leaves of infected tobacco plants exhibited slight curling, twisting, bending of tips and narrowing. Though the source from which diseased scions were obtained was the same it produced two different types of symptoms in tobacco plants which may be due to difference in reaction of individual plants.

FIG. 2.

Solanum tuberosum.—The disease was successfully transmitted to potato plants of varieties *Phulwa, Craig's defiance, President* and *Arran Victory*. The *Phulwa* plants only exhibited foliar necrosis whereas in *Craig's defiance* the disease produced smalling and necrotic areas on young leaves. In potato variety *President* the top young leaves completely turned brown and dried up whereas the young leaves of variety *Arran Victory* developed necrotic areas and later turned completely brown. Fig. 2 shows an infected *Arran Victory* plant. All efforts to transmit the disease to *Lagenaria vulgaris* Seringe were unsuccessful.

The symptoms on differential hosts show that necrosis in *Darjeeling Red Round* variety had been caused by a mild strain of tobacco leafcurl virus (*Nicotiana virus* 10). This view is further confirmed by the fact that the disease is transmitted by *Bemisia gossypiperda* M. and L., vector of the tobacco leafcurl virus. In India tobacco leafcurl virus is wide spread and is responsible for serious losses to the crop. The disease has a wide host range and may, therefore, become a limiting factor in the cultivation of potato crop.

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ERGOT SCLEROTIA ON *SORGHUM VULGARE* PERS.

THE incidence of the sugary disease of *Sorghum* caused by *Sphacelia sorghi* McRae in South India is observed almost annually in crops maturing in December-January. But in this province the sphacelial stage alone had been recorded so far. Ajrekar (1926) has described that sclerotia were formed but that they were overgrown with *Cerebella* and yeasts and that they did not germinate. Barger (1931) states that "a specimen of *Sorghum* in the herbarium of the Imperial Bureau of Mycology shows numerous slightly curved sclerotia, 10 to 12 mm. × 2 mm." Robertson (1928) reported long hard horn-like sclerotia on *Sorghum* from Burma.

In November 1946 heavy incidence of sugary disease of *Sorghum* was noticed in Koilkuntla, Kurnool District (Madras Province). Specimens of ears obtained from this area exhibited profuse sclerotial formation. Almost every other spikelet had one cylindrical, elongated or slightly curved sclerotium of cream to grey colour. These were 1 to 2·5 cm. long and 4 to 6 mm. thick and to all appearances resembled young sclerotia of ergot of rye. Some of these sclerotia were kept in moist sand at 5° C. for over one month and then removed to 20° C. But there was no sign of germination even after three months.

A cluster of 3 spikelets with sclerotia and a single sclerotium (× 1·25)

Surface sterilized sclerotia were cut into bits and kept on Kirchoff's medium. Mycelial growth developed and from this the fungus was multiplied. The growth of the fungus on Kirchoff's medium was white in colour with plenty of ærial hyphæ. But the rate of growth was very slow compared to that of ergot of rye. At laboratory temperature (26° C. – 28° C.) the growth was slower than at 20° C.–23° C. Sporulation was evident in fifteen to twenty days. The conidia were of various shapes and sizes. Some were like the conidia found in nature. Others were smaller, oval or elongated and narrow. Transfers were made on sterilized young panicles of *Sorghum* and greater sporulation resulted on this substrate.

A suspension of the spores from the cultures was used for inoculation of young flowers of *Sorghum*. It was sprayed by an atomizer before the flowers opened, at the time of flower opening and after the anthers had all been shed. Successful infection was easily obtained in the first two stages, the highest incidence occurring when inoculation was carried out at the time of flower opening. At Coimbatore, however, only the 'honey-dew' stage developed. The sclerotium did not develop in any of the infected ears. Obviously a cooler climate is necessary for this, as the occurrence of the sclerotia has been observed only at higher latitudes.

The sclerotia were assayed following the method described by Mukerji and De (1944). There was not the slightest trace of the blue colour in the extract after the addition of the reagent indicating thereby that ergotoxine is not present in the sclerotia. Consequently ergot poisoning is not to be expected when cattle are allowed to eat ergotized ears of *Sorghum*.

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June 25, 1948.

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A UNIQUE CASE OF ARTERIAL ABNORMALITY IN *RANA TIGRINA* DAUD.

ALTHOUGH numerous cases of abnormalities in the Venous System of the Anura have been recorded from time to time, very few instances affecting the aortic arches have been hitherto noted. Crawshay (1906)[1] described a female individual of *Bufo boreas*, in which there was a common systemico-pulmonary arch on the right side posterior to the origin of the large cutaneous artery. Sweet (1909)[2] found an abnormal connection between the internal carotid and the systemic in an individual of *Hyla aurea*, as well as two cases of the presence of accessory aortic arches in the same species. Benham (1919)[3] in *Hyla aurea*, and O'Donoghue (1933)[4] in *Rana temporaria*, recorded in certain cases the abnormal presence of four aortic arches instead of three. Mozejko (1919)[5] reported on the absence of the left pulmocutaneous arch in *Rana esculenta*, and

Young (1924)[6] on the absence of union between the two systemics in *Rana pipiens*. Avel (1929)[7] found that in a specimen of *Bufo vulgaris* the right subclavian artery arose from the pulmocutaneous arch at the point of its bifurcation, while in another specimen the cutaneous artery arose from the left aortic arch. O'Donoghue (1931)[8] recorded in *Rana temporaria* the absence of that portion of the right systemic arch which normally lies between the point of origin of the subclavian and the junction of the two systemics, and also discovered (1935)[8] an abnormal occipital artery arising from the systemic arch, as well as an abnormal subclavian, in *Rana temporaria*; while Khatib (1938)[9] noticed a case of *Rana tigrina* in which two vessels arose close together from the right systemic arch at its origin, the inner one joining with the external carotid by a branch.

deserves mention. The individual was an adult male, and had been injected by me with carmine.

The arrangement of the arteries (Fig. 1) was normal on the right side, but on the left only two arches arose from the truncus arteriosus—a systemico-carotid arch and a pulmocutaneous one. The latter showed a normal distribution, but the former—the first case of a joint trunk of this type in the Anura—gave off the left external carotid artery a little way off from its point of origin, had a carotid labyrinth immediately distal to the origin of this artery, and passed from this point outwards, backwards, and upwards to assume a dorsal position. The left internal carotid artery arose not from the carotid labyrinth as is usual, but quite a way off from it from the conjoint systemico-carotid trunk near the dorsal region of the œsophagus. Thus, on account of its posterior origin, it was more elongated than the right one. After the origin of the left

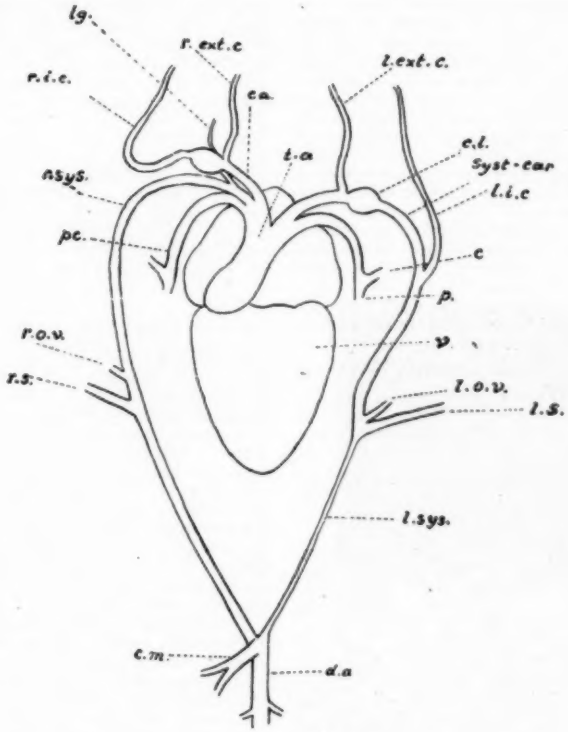

FIG. 1. Disposition of the main arteries in the abnormal specimen of *Rana tigrina*. *c*, cutaneous artery; *ca*, Carotid trunk; *c. l.*, Carotid labyrinth; *c. m.*, Cæliaco-mesenteric artery; *d. a.*, dorsal aorta; *l. ext. c*, left external carotid artery; *lg.*, laryngeal artery; *l.i.c.*, left internal carotid; *l. o. v.*, left occipito-verteoral artery; *l.s.*, left subclavian artery; *l.sys.*, left systemic arch; *p.*, pulmonary artery; *pc.*, pulmo-cutaneous trunk; *r. ext. c.*, right external carotid artery; *r.i.c.*, right internal carotid artery; *r. o. v.*, right occipito-vertebral artery; *r.s.*, right subclavian artery; *r. sys.*, right systemic arch; *syst-car.*, abnormal systemo-carotid trunk of the left side; *t.a.*, truncus arteriosus; *v.*, ventricle.

This year I came across a unique case of aortic abnormality in *Rana tigrina* Daud., which

internal carotid, the arch passed obliquely backwards towards the median line and, after giving rise to the subclavian artery, became an extremely attenuated vessel, running backwards as the left systemic trunk to join its fellow of the other side. The presence of the injection mass inside showed that this attenuated section of the systemico-carotid trunk was a vessel, and not a ligamentous structure. There was no left laryngeal artery, and the occipito-vertebral and subclavian arteries, unlike those of the right side, arose from a common point from the left systemico-carotid trunk.

When we compare this abnormal disposition of arteries with the normal condition found in *Rana tigrina*, the deviation appears to be due to the fact that the carotid and systemic arches of this side are not separated from each other, but remain as a single undivided trunk—a view which is supported by the absence of a partition separating the carotid and systemic channels from each other inside the conjoint vessel. The attenuation of the systemic artery posterior to the origin of the left subclavian may be correlated with the extremely small amount of blood left over to be transmitted from this side to the dorsal aorta.

The presence of a conjoint systemico-carotid arch in this case reminds one of the Reptilian condition where such an arch is present normally, although on the right side.

I am extremely grateful to Prof B. C. Mahendra for his guidance and help in the preparation of the present note.

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THE VASIFORM ORIFICE OF LARVAL ALEURODIDÆ

THE vasiform orifice constantly present in all Aleurodids, is one of the major characters on which the generic classification of the group is based. There has been a considerable difference of opinion regarding the morphology and function of the operculum and the lingula, which are invariably associated with the orifice (Fig. 1). Peal[1] considered the vasiform orifice as a special secreting structure and honey dew to be connected in some way with the circulation of the larva. Bemis[2] appears to have a somewhat similar idea about the lingula. According to her in some species, there are seen minute blunt tubes on the apex of the lingula, through which the fluid may be secreted. Tullgren[3] regarded the vasiform orifice as the anal opening. Quaintance and Baker[4] believed that the anus opened below the lingula, which therefore, functioned as the supra-anal plate, the operculum being the rolled back edge of the lingula. Hargreaves[5] showed that the anus opened above and not below the lingula.

My studies on the fourth instar larva of *Dialeurodes eugeniæ* Maskell clearly show that

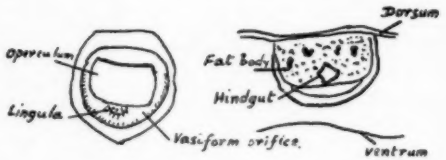

FIG. 1. Dorsal view vasiform orifice

FIG. 2. T. S. through vasiform orifice

the vasiform orifice is a shallow depression of the dorsum, lodging the operculum and the lingula within (Fig. 2). Both the operculum and the lingula are hollow, containing extensions of the hæmocœle. Therefore they should be regarded as abbreviated abdominal segments of the larva. The structures regarded as tubes by Bemis are merely cuticular spines. The posterior part of the hindgut traverses through the operculum and terminates into the anus above the anterior end of the lingula. The operculum is provided with muscles and by its forceful movement against the lingula squirts out the liquid fæcal matter in the form of a droplet, at some distance from the body of the larva. The elongated and setose form of the lingula appears to guide the outward flow of the fæcal drop. The pit of the orifice probably enhances the free movement of the operculum and the lingula enabling the larva to jet out fæcal drops in several directions. In short, the three structures form a mechanism for the proper defeciation of the larva. A full account of the larval anatomy will be published elsewhere.

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REVIEWS

Weapons of World War II. By Major-General G. M. Barnes. Pp. xiv + 317. (New York : D. Van Nostrand Co. Inc.; London : Macmillan & Co., Ltd.). 42 *sh.* net.

The World War II has seen very substantial advances in weapons and equipment as regards both technique and fundamental concepts and there could be few officers better qualified to discuss these than Major-General Barnes, Chief of the Ordnance Department, USA Army, during the war years and with a service of 36 years in the regular army. Major-General Barnes' book which succeeds in making a survey of the American work in the field so opened up, is therefore most welcome and is, I believe, the first comprehensive publication of its kind.

This profusely illustrated volume is not a mere catalogue with explanatory notes on each item but it gives a vivid and authentic picture of a vast number of widely differing types of army and air-force weapons necessary to equip a modern army. The treatment of the topics is necessarily brief on account of the wide range covered but in general the essentials are emphasized and a satisfactory story presented. Particularly valuable features of the book are that development and action photographs of weapons and vehicles are given, their principal characteristics are set forth in full in a tabular form easy for reference, the highlights of their development are discussed and the role that each played during the war is mentioned. An appreciation can therefore be made of their relative merits and fields of application.

There is an excellent description of the organisation, charter, activities and various committees of the Ordnance Department of the USA Army in the Introduction. It may be mentioned here that the corresponding organisation for research and development in the UK is under the Ministry of Supply instead of under the Army.

The first five chapters in the book deal with arms and ammunition, and the latter two with 'A' and 'B' vehicles, new apparatus and instruments. The last chapter contains the author's conclusions. This is a very satisfactory arrangement.

Chapter I deals with the design and development of small arms and ammunition, those requiring special mention being the automatic rifle, 'bazooka', recoil-less rifles and the aluminium—nylon principle for body armour.

Chapter II lays down the basic characteristics of anti-aircraft armament and describes aircraft cannon of calibres 20 mm. and larger.

Chapter III deals with the design and development of improved types of ammunition such as explosives (RDX, PETN, cyclonite, Haleite), propellants and primers, flash reducers, shaped charges (hollow charges), artillery fuses specially the VT fuse, grenades, both hand and rifle, mines, anti-tank and anti-personal, mine exploders, signals and flares, bombs of various types including anti-ricochet attachments for general purpose bombs.

Chapter IV deals with the design and development of all types of field artillery (light, medium and heavy) provided with accurate fire control instruments and 'capable of functioning efficiently equally well on the Arctic Circle or at the Equator'. Development of anti-aircraft weapons of various calibres is also described together with automatic anti-aircraft fire control system worked by electronic power control. This is followed by a description of the development of mortars and ammunition of calibres commencing from the small 60 mm. existing before the war, through intermediate sizes, to the 941 mm. Mortar (36″ in bore).

Chapter V traces the development of rockets of various types and sizes, their launchers and propulsion units.

Chapter VI, the largest in the book, is devoted to the design and development of both 'A' and 'B' type vehicles which include Tanks (light, medium and heavy including swimming devices for the first two categories), armoured cars, self-propelled gun carriages for light as well as heavy guns, and various types of army transport vehicles such as trucks, high speed tractors, tank transporters, cargo carriers and particularly trucks amphibian (DUKW).

That these amazing advances in design, development and production of the weapons and vehicles described so far would not have been possible but for the *pari passu* development, standardisation and conservation of materials and their substitutes, is dealt with in Chapter VII. Investigations into designs and development of existing and new weapons of warfare and in their accurate use were very much facilitated by new apparatus and instruments such as Electronic Computing Devices, Supersonic Wind Tunnel, Aerodynamic Spark Range, Blast measuring instruments, Ballistic Camera, Flash X-ray apparatus and technical intelligence reports about enemy Ordnance including those then in their research and development stage.

The author emphasises that the partnership formed by the Ordnance Department with American Science and Industry, what he calls the Science-Industry-Ordnance team, yielded results beyond expectation in the design, development and production of Ordnance equipment and he is full of praise for the sound work done by the numerous Scientific and Engineering Advisory Committees. He advocates in the concluding chapter that—

(i) No service laboratories be established except for those fields which are not covered by university, private and industrial laboratories.

(ii) Research and development problems of the Services be "farmed out" to qualified universities, private and industrial laboratories.

(iii) Preparations should be ready for prompt mobilization of the entire industrial capacity of the nation, with its manpower.

The style of presentation in the book is narrative and lucid and it provides interesting

reading. There is no displacement of photographs with respect to the text, there are hardly a few trivial misprints and there is a good and adequate index at the end. The book is well produced.

Major-General Barnes' book will prove to be of great interest to all scientific and technical men who have a specialist interest in the research and development of weapons and equipment for the Services, to Army Officers who will find it useful as a reference book wherein the characteristics and performances of various American arms and vehicles can be readily seen, and to general readers to enable them to obtain sufficient grasp of the advances so far made to follow the current development.

R. S. THAKUR.

One, Two, Three ..., Infinity. By George Gamow. (London: Macmillan & Co.) Pp. 340.

A popular book dealing with facts and speculations of Science, written by a distinguished Professor of Theoretical Physics, one who has already other popular books on Science to his credit, is bound to deserve attention and to be widely read. Looking at the title of the book, one will possibly expect in it an account of the mysteries of numbers, or some such topic. But, glancing through the pages, some may exclaim whether 'infinity' refers to the number of topics dealt with, for we find therein topics on ordinary numbers, enumerability, number of primes between 1 and N, the four-colour problem, Möbius surface, Relativity, atomic structure, nuclear physics, problems on probability, the living cell, chromosomes, bacteria, stars and the Galaxy, the origin of the solar system, Interior of the stars, the expanding universe, and so on. A careful and intelligent study however reveals that all these topics group themselves under four broad divisions: Numbers, Space and Time, the beginning and mechanism of Life, and the Origin of the Universe. These are harmoniously welded together so as to form a "Study of the Universe as interpreted by scientific observation". From this broad standpoint of view, the book is illuminating, and provides for the layman as well as for the scientific explorer, a most enjoyable book for his leisure hour. "The time has come", the Walrus said, "to talk of many things", and we warmly congratulate Prof. Gamow on his assuming the role of the Walrus so successfully.

C. N. S.

Modern Magnetism. By L. F. Bates. (Cambridge University Press, Second Edition 1948. Pp. xii × 440.) Price 25 *sh.* nett.

The first edition of this book was published in 1939. The aim was to present a detailed account of the fundamental experiments in magnetism with the necessary background of modern theory. The book was no doubt greatly appreciated by workers in the field of magnetism.

Since the publication of the first edition, much new material has been collected in spite of the handicaps brought about by the War. The phenomenological theory of hysteresis, described by Becker and Döring in their book *Ferromagnetismus* (Springer, 1939) gave a new and logical interpretation to domain structure. Considerable fundamental work has been carried out on the preparation of high permeability alloys. Very exciting results have been obtained by radiofrequency techniques with molecular beams. An interesting example is the case of the discovery of the existence of a quadrupole moment in the deuteron. Considerable work had been done during the war years in the Netherlands or paramagnetic dispersion and absorption.

Most of this new material has not so far been presented in book form. Professor Bates, who has himself contributed much to this extension of magnetic knowledge, has done a great service to workers in Magnetism by collecting this large amount of interesting information and presenting the details in a connected form. The additional information has been given in the form of six new chapters and a few supplementary notes.

Apart from specialists in magnetism, students of the physical sciences will find much in these chapters that would be of great interest and importance.

S. R. R.

Cathode-Ray Oscillograph in Industry. By W. Wilson, Third Edition Revised, 1948. (Messrs. Chapman & Hall, London.) Pp. xii + 252. Price 18 *sh.*

The second edition of this book was reviewed in *Curr. Sci.* in considerable detail and was noticed as a very useful addition to the available literature. Hence, it is proposed to refer only to the special additional features of the third edition only.

The section on the fluorescent screen has been re-written and the literature published recently in the *I.E.E.*, Part III —Radio Location Convention, has been usefully utilised. This is a necessary and an important change. A very useful discussion on the advantages, etc., of the two types of deflection, *viz.*, electrostatic *v.* magnetic deflection has been added. There is an Appendix F dealing with the recent developments employed in Radio Location. Herein, some of the wartime developments like the P. P. I., the post-deflection acceleration, Lens magnification of the screen, etc., are briefly but very simply and clearly described. The author had to resort to this procedure of putting all this in a short appendix owing to the printing difficulties. It is to be hoped that all these features will come up for a non-detailed description in the next edition.

The third edition is definitely an improvement and increases further the utility of this excellent book.

S. V. CHANDRASHEKHAR AIYA.

Glacial Geology and the Pleistocene Epoch. By R. F. Flint. (New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd.) 1947. Pp. xviii + 589. $ 6·00.

Students of the Pleistocene epoch owe a debt of gratitude to Professor Flint of Yale University for this invaluable book. As the title indicates, the book does not deal with every phase of the Pleistocene. Information regarding this Epoch has grown so rapidly that a complete reference work would become very

voluminous. In Historical Geology, the longest and most important chapter is upon the latest and shortest of the geological periods. The author has not, therefore, attempted to make the book an encyclopædia but a summary of the essential features of the Pleistocene epoch which could be of use not only to geologists, but to ecologists, archæologists, and geographers.

The book is essentially a discussion of the Pleistocene epoch from the point of view of glaciation which is the special feature that distinguishes this epoch from the epochs that preceded it. The book, therefore, deals mainly with glaciation, its causes and its effects, and the criteria of its recognition.

What might otherwise have become a voluminous production has been avoided by a long list of references given at the end of the book which contains nearly 900 separate items; this is apart from numerous references found in the body of the book. There are six folded plates at back of book containing glacial maps. Included in the text-figures are 70 maps and diagrams, and 18 photographs. There are as many as 30 tables.

The book is a monument of careful and painstaking accumulation of a vast quantity of information. It will be widely welcomed not only by students of the Pleistocene Epoch, but by workers in other allied fields who are interested in problems of the prehistoric realm.

C. S. PICHAMUTHU.

Insect Pests of Cotton in India. By H. D. Nangpal. (Indian Central Cotton Committee.), 1948. Rs. 2.

This is a comprehensive list of the entire insect fauna associated with Cotton in India with a useful note on the cultivation of the crop in the different regions. While there is no doubt that all species dealt with affect the cotton crop at some stage or other in some part of the country or other, it would have been preferable if those species that are serious and important pests (like the Bollworms, for example) had been treated at much greater length. In its present form, therefore, this publication while serving as a guide to the cotton farmer or Agricultural Officer is not very useful to the working Entomologist as the information supplied is too meagre and elementary.

The book suffers from some omissions which seriously detract from its value for reference work. A map of India marking out the different cotton regions referred to in the introductory part would have been very useful; the total absence of illustrations of atleast the most important pest forms is a serious disadvantage especially to the lay reader wishing to derive practical instruction from the book. Even if colour plates are out of question in these difficult days simple line drawings of the different stages of important pests or reproductions of photographs would have served well. The arrangements of the pests under different heads is somewhat elementary and arbitrary; it may lead the lay reader to think that each species is definitely restricted to the stage and part of the cotton plant allotted to it in the book while this is not so. The bibliography attached to every species might have profitably included references to important recent work outside India. In the glossary of botanical 'terms' at the end, the repetition of botanical names in both the columns (where popular equivalents in English or vernacular are not available) serves no purpose, and the repetition of some names like Banyan tree, Cabbage and Euphorbia, is confusing; the vernacular equivalents are mostly all from North Indian languages and in a book covering cotton cultivation in the whole country the author could have taken pains to collect South Indian names also. Errors have been allowed to creep in here and there in regard to scientific names (Styled 'Latin' names in the text) of insects, probably by careless proof-reading. In the next reprint these mistakes may be eliminated.

In conclusion, this handy-sized publication supplies a long-felt want for a complete list of the insect fauna affecting Cotton in India, with brief notes on their seasonal and geographical distribution, parasites and predators, and control measures. It may be confidently recommended for reference work to large-scale farmers, Farm Managers and Agricultural Officers working in Cotton tracts to enable them to indentify pests in the initial stages of attack and thereby to initiate control measures by prompt reference to competent authority.

D. SESHAGIRI RAO.

Endocrines and Constitution in Doves and Pigeons. Publication 572, By Oscar Riddle, Department of Genetics, Carnegie Institution of Washington, Price $ 3,00 (paper cover). Pp. ix + 306; 1947.

This study deals primarily with the outcome of an attempt to isolate strains or races of ring doves with diverse endocrine-associated traits through choice of 24 pairs of doves (from more than 200 pairs) whose reproductive performance and ancestry were known. Selection sometimes continued for two generations; inbreeding was sustained. Outcrosses provided many hybrid types and also further tests of the heritability of traits. Collection of data from all types was continued during 24 years. Of secondary importance are related results obtained from 12 races of domestic pigeons and from 15 derived hybrid types; from them was developed a race of hermaphrodite producing pigeons. Exceptionally abundant data were obtained on the role of sex, hybridity, and race in heat production.

The primary tests with doves successfully established races with the following traits: With or without sex difference in body weight; small or large thyroids; long or short intestines; high or low response to the hormone prolactin; larger or smaller pituitary glands; early or late sexual maturity in females; larger or smaller eggs; larger or smiller juvenile testes; high or low rate of heat production. Widespread genetic inequalities of individuals and races were thus demonstrated in this material. Most of these results are theoretically applicable to man, and thus provide cogent evidence for biological inequality of human individuals, types, and races.

Marketing of Fish in Bengal*

We welcome the new series of self-contained *Bulletins* issued by the Royal Asiatic Society of Bengal, whose primary aim, as stated by the Secretary of the Society in his foreword to the first Bulletin, is to furnish a channel of quick publication of suggestions likely to lead to the development of the natural resources of the country. It is appropriate that the first two bulletins, which have now been published, deal with the problems of fisheries which have an all-India interest and importance in augmenting the country's food supplies. Bull. No. 1 is "The Marketing of Fish in London with Comments on the Needs of Calcutta," by S. L. Hora, the former Director of Fisheries, Bengal, and No. 2 is "Suggestions for the Improvement of the Production and Marketing of Fish in Bengal," by T. J. Phillips, Secretary, London Fish Merchants' Association.

Hora gives an account of the fish trade in London and based on this background puts forwrad a scheme for the general improvement of fish trade in Bengal, more particularly Calcutta. His thesis is that, so far, no permanent progress has been made in the supply and marketing of fish in response to reform from the end of the primary producers and that trial should now be made from the other end, namely, marketing of fish in big towns. For this he suggests the setting up of a Central Fish Market for Calcutta, functioning on lines similar to those of the Billingsgate Market in London, which will handle the entire fish trade of Calcutta. In a twenty-years programme of improvement, which he outlines, all attention is to be concentrated on setting up such a Central Market and Cold Storage during the first five years, improvements of facilities for assembling and handling fish to the next five, organizational facilities for procuring and increasing the production of fish to the next five, whereas administrative measures for the management of fisheries are to come during the last five years.

Phillips' paper covers a wider field and he groups his remarks under the heads of (1) Production; (2) Distribution; (3) Marketing; (4) Prices; (5) Selection, Grading, Packing and Preservation; (6) Transport; (7) Cold Storage and (8) Disposal of Waste. He rightly points out that it is of prime importance that production should be increased to the greatest possible extent in the shortest possible time. This is in sharp contrast to Hora's scheme where increased production is to come only in the third five-year phase in spite of the enormous gap between supply and demand,—a gap which according to Hora's own figures for the city of Calcutta gives an average value of about 259 tons of fish per day! Phillips would, therefore, give high priority to the provision of the most up-to-date equipment in the case of marine fisheries and the stocking and management operations of freshwater fisheries. For distribution he advocates a rigid system of licensing of traders combined with a zonal scheme to be drawn up to ensure that each fishing centre would provide the supply of fish for a given adjacent zone, either individually or in groups, thus making it imperative that supplies should be sent from centres only to specified areas. The three phases of marketing, *viz.*, the landing phase, the wholesale market and the retail market are discussed and suggestions are made regarding price grading, packing and preservation for transport and storage. The need for disposal of "condemned fish" is emphasized and in his words "it should be made impossible for any person to obtain possession, for eating purposes, of fish which is unfit for consumption". He strongly disagrees with Hora in his proposal to concentrate upon the organization of the Calcutta Market during the first period of five years leaving the organization of the assembly centres, the organization of the fishermen and promotion of production and other measures to subsequent phases. The following remarks of his are applicable not only to Bengal but to the whole of India. "Whilst having due regard to the fact that the fish industry of Bengal is probably about a thousand years behind the times and that its complete modernization cannot be effected overnight, I would most strongly advise against attempting to remedy the position by concentrating upon one aspect only. In my view it is necessary to adopt a comprehensive policy under which measures would be taken from the outset to promote improvements in production, transport, markets and marketing methods, in conjunction with control of prices and distribution, so that the whole industry might move forward in step. This would, I believe, give a much more solid foundation and substantial improvement should be possible within even the first five years."

In these two Bulletins there is much information of value by way of suggestions which could be followed up with advantage in programmes of fishery development. In our view Hora has overemphasized the need for centralizing fish trade. It is not made clear whether the market envisaged is a Central wholesale market like Billingsgate or a combined wholesale and retail market but, in either case, taking into consideration the tropical conditions under which sales have to take place and the large population to be catered for, the Central Cold Storage cannot effectively serve the retailers and the public without many smaller units distributed in the city. In fact, it may be legitimately asked whether the latter should not have priority over the big Central market. A less ambitious, but perhaps more practicable, programme will be to have adequate and efficient cold storage units for fresh fish, with all attendant improvements, in the different markets scattered about in the city. It should be remembered that the consumer does not live on fish alone and that most people would like to purchase all their requirements from the same shopping area convenient to them. Many municipal corporations in India are now thinking in terms of cold storage for all perishable foods associated with markets; these could have separate fish units and most of Hora's suggestions could be adopted for these smaller units without the drawbacks of overcentralization. In the scheme outlined by

* Bulletins Nos. I and II, published by the Royal Asiatic Society of Bengal, Calcutta, 1948.

Phillips, it appears to us that there is a tendency to underrate the practical difficulties in dealing with fishing folk who are not advanced enough to understand and appreciate what is good for them except in terms of immediate cash gain. These remarks are in no way intended to minimise the value of these two stimulating contributions, whose authors have done real service in putting forward their views and have thus provided material for constructive thinking which should help fishery workers to arrive at solutions embodying the best that is practicable in these memoranda.

SCIENCE NOTES AND NEWS

Abnormality in the Venous System of *Rana tigrina* (a full-grown specimen)

Mr. D. Vaidyanathan, Biology Department, Bavan's College, Andheri, Bombay, writes:—

In one of the specimens dissected by a student of the Inter Science Class, it was noticed that the *abdominal vein* (anterior abdominal) instead of emptying its contents into the liver abruptly stopped on its way up and found to remain attached to the inner body wall. It was just ¾th the usual length of a full-grown specimen and was full of venous blood. Whether this blood remained stationary in that vessel or it flowed back into the two pelvics (which obviously cannot happen, it being a vein) is a matter which requires explanation. However, in this case, the presence of the abdominal vein does not appear to serve any purpose (I mean taking away a load of venous blood collected from the hind limbs to the heart through the liver) and if this is so, can it be said that its total absence would not cause any hardship to the living animal?

Dr. S. L. Hora

In recognition of his "great contributions to tropical zoology" and the "spirit of co-operation and friendship" extended by him to his colleagues abroad, Dr. S. L. Hora has been awarded the Honorary Membership Diploma of "S. Plantentuin". In a communication addressed to Dr. Hora, Dr. L. G. M. Bass Becking, Director, Botanic Gardens, Buitenzörg, declares that "it is really the feeling that scientists in this part of the world should stand together in a solid phalanx, to oppose foolish measures, to combat stupidity and to further speedy reconstruction that prompted us to ask you to accept this nomination".

Medium of Instruction at University Level

The Ministry of Education, Government of India, have constituted a 26-man Committee to (1) determine the medium of instruction and examination at university level; (2) to determine the placeof English in university education; (3) to consider the stage when English should be replaced by the National or Regional language in secondary or higher education; (4) the question of script and (5) to determine scientific terminology.

Rhodes Scholarship for India

Rhodes Scholarships were founded at Oxford under the will of Cecil Rhodes to help the students of the dominions and colonies to prosecute studies at Oxford.

The essential attributes of the Rhodes scholar is that he should have physical courage, vigour and an interest in his fellowmen. Two scholarships are allotted to India. Only men are eligible. Candidates are selected from either of the following groups:

Service candidates who must have done at least one year of war service and who were between 19 and 25 years of age between September 1939 and August 1945.

Ordinary candidates between 19 and 25 during October when the universities reopen in U. K.

All candidates must have obtained a first class degree in arts or science of an Indian University. Ordinary candidates must be unmarried.

The scholarships are tenable for two years at Oxford. The third year scholarship may be granted in some cases and candidates may be allowed to work in other universities in U. K.

The scholarships are worth £ 400 (Rs. 5,325).

Liquid Fuels from Coal

Preparations for the manufacture of one million tons of motor spirit and diesel oil are under way. A batch of technicians has already gone to a colliery in Eastern India for this purpose. This is the result of an agreement concluded recently between the Government of India and an American firm who are experts in carbonising and gasification of coal.

Telephone Factory

An automatic Telephone Factory, decided to be started by the Ministry of Communications of the Government of India, will be located at Krishnarajapuram, about seven miles from Bangalore. The Government of Mysore are extending all facilities such as water, electric power and an extensive site for the location of the Factory.

World Cultural Co-operation

The Government of India have formed a committee to determine the constitution of the Indian National Commission, recommended by the UNESCO, in order to work in co-operation on matters of general interest among the member States of the United Nation's Organisation.

World Congress of Orientalists

The Indian Delegation to the 21st session of the International Congress of Orientalists was led by Sir S. Radhakrishnan, Professor of Eastern Religions and Ethics at Oxford University. The next session of the Congress is expected to be held in New Delhi in 1951.

World Health Organisation

The Regional Headquarters of the Organisation is to be established at Mysore. The Government of Mysore have agreed to provide all a cilities for the location of the Institution.

Central Institute of Indigenous Medicine

The Government of Mysore have offered the Central Government attractive terms for the location of the Central Research Institute at Bangalore. Bangalore, in addition to its salubrious climate, is one of the foremost centres of scientific research in the country.

International Congress of Industrial Medicine

The Indian Medical Association has been invited to send representatives on behalf of India to the Ninth Session of the Congress to be held in London between September 13 and 17.

Congress of Commonwealth Universities

India will be strongly represented at the Congress of the Universities of the Commonwealth, which opens at Oxford on July 19.

It will discuss such vital topics as the relations between the State and the Universities, inter-university relations and reviews, from points of view of the historian, philosopher and sociologist of the structural and moral changes produced in modern society by scientific and technological advance.

The discussions will also cover the balance of research and teaching at universities and general plans for colonial higher education.

UNESCO and other international scholastic organisations and many foreign countries will be represented at the conference which will last for five days.

The Asian representatives will include 24 from Indian universities and colleges, 13 from Pakistan, five from Ceylon, eight from Singapore, two from Hong Kong and one from Burma.

British Commonwealth of Nations Scientific Liaison Offices B. C. S. O. (London)

The British Commonwealth of Nations Scientific Liaison Offices (London) have been opened on the third floor of Africa House Kingsway, W.C. 2. This is one of the measures to facilitate co-operation in the civil aspects of science within the Commonwealth decided on by the British Commonwealth Scientific Official Conference, held in London in 1946. For a number of years several of the Commonwealth countries have maintained scientific liaison offices in London and these together with the ones about to be established will now have their headquarters in Africa House. Each of these offices will continue to operate as in the past, retaining complete independence of action, but the convenience of occupying adjacent premises will facilitate co-operation between them on matters of common interest. For ease of reference to the group of independent offices as a whole the title given above has been chosen, with the abbreviation B.C.S.O. (London) for common use. The offices taking part in the scheme are the Scientific Liaison Offices of Australia, Canada, Central African Council, India, New Zealand, South Africa and the United Kingdom. Pakistan and the Commonwealth Agricultural Bureaux will be represented and the Overseas Liaison Division of the U.K. Department of Scientific and Industrial Research will work in Africa House.

In Washington the scientific liaison offices of the Commonwealth countries are associated under a similar scheme.

Tuberculosis Association of India—Annual Report for 1946

The Secretary of the Association in his letter dated 14th July 1948 writes :

With reference to para 4 (page 133) of the Review of our Annual Report for 1946 in your number for April 1948, I am to bring to your notice that the term "D. T. D." as mentioned in our Report is not an error. The Diploma Course instituted by the Delhi University is known as Diploma in Tuberculoris Diseases.

ERRATA

Vol. 17, No. 5, May 1948

Note on "Heat Conductivity and Molecular Weight of Liquids".

Page 148, Col. 1, Para 2, line 16 —
for "$K_{R.P.}\sqrt{}$" *read* "$K_{R.P.}\sqrt{M}$"

Vol. 17, No. 5, May 1948

Note entitled "On the Food of the 'Bekti,' *Lates calcarifer* (Bloch)".

Page 157, Col. 1, line 5 *read* (2·15 per cent.) *for* (12·15 per cent.)

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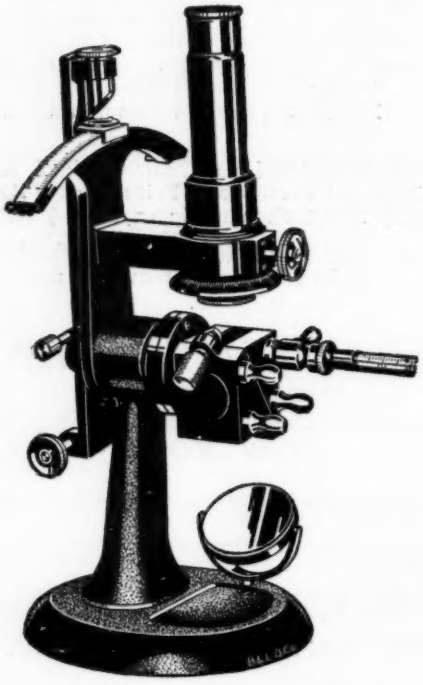

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